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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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VOL. 19. No. 32.

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An Improvement.

When a manufacturer sees a chance to cheapen his product, make it better or more convenient, he does not hesitate to change the design of a machine—he would think it folly to wait until the end of the year.

The production of a technical paper like the AMERICAN MACHINIST is a manufacturing enterprise.

We have found a way to make our paper better and save time by a slight rearrangement of pages without changing the form at all.

By putting advertising front and back of the reading matter we can dispense with a pasted cover, which means a great delay as every wrapper must be put on by hand.

This plan will enable us to use fine coated paper on the form having the engravings—paper costing double that previously used.

It will enable us to get the paper out more promptly and to add four pages without increasing the cost.

The design on the front cover we have abandoned in order to satisfy a demand for a more complete table of contents.

The paper is a plain business affair, and needs adornment no more than a planer needs fluted columns—we will use this space for advertising.

That there may be no hard feelings in the matter, we shall decline to sell permanent space here to any one concern. The whole space, 4½x7½ inches, will be sold from week to week to the first applicant for $100 net. No one concern can have it twice in succession if there are other applicants for it.

This little change will give our readers a bigger paper, that opens better, is better printed, and in quicker time than heretofore. This is an improvement that we consider we could not afford to wait until January 1st to inaugurate—there is no more sense in making newspaper improvements on that date than in bringing out improvements on drills at Easter or lathes at Yule Tide.

THE MANAGEMENT.

The Arcade File Works.

Look at this file lengthwise in a slanting direction, the irregular lines show wherein Arcade Files excel.

97 Chambers St., New York.

118 Lake Street, Chicago.

Works, Anderson, Ind.

Makers of

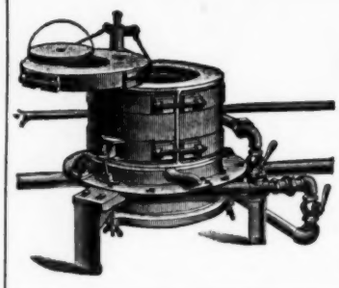
Weed's Pat. Increment Cut Files.

Johnson's New Universal Encyclopedia says:

"The difference between this, and the perfect regularity of other kinds, must be apparent, particularly in double-cut files; as in the one case, the file cut with such extreme regularity, when put to use, will in the first inch of its movement, produce channels or grooves, and these grooves will continue to be made deeper as the file is shoved along producing that 'grooving' and 'chattering' so often complained of; while with the Increment Cut File, the grooves made by the movement of the file for the first inch, will have their sides cut away, as the file is moved toward the tang or handle, and *vice versa*; and while it is cutting as fast as its points permit, it is also said to cut smoother than the best hand-cut file of the same coarseness. The irregularity spoken of, consists not only in the space between the teeth, but also in the height of the teeth themselves. The object of having the teeth of different heights is to admit of their being held down to the work, with less effort on the part of the workman."

We guarantee our files to cut faster and wear longer than any on the market, and will send to any responsible party, one dozen of our Arcade Files with Weed's Improved Increment Cut, and if, after test, they are not found to be the best files ever used, we will make no charge.

An interesting souvenir, Facts and Suggestions About Files, sent on request. New York Office only. . . . . .



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OIL GAS PLANTS

Gas Blast Furnaces & High Pressure Blowers

For the economical generation and systematic application of HEAT.

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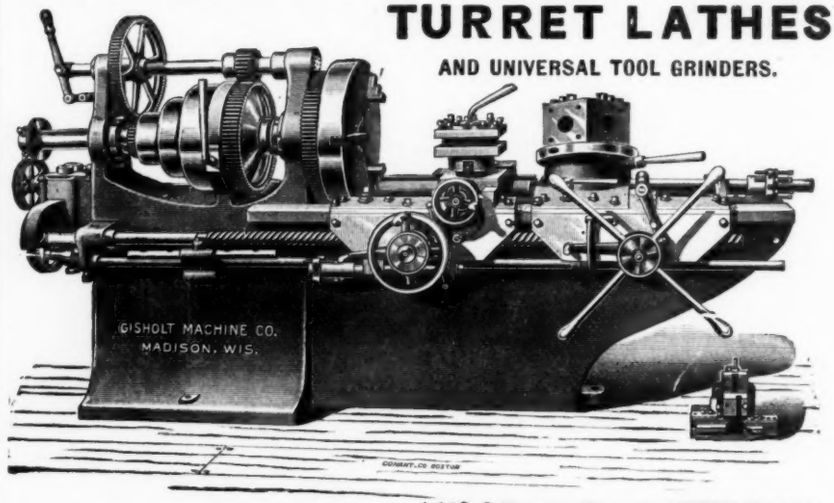

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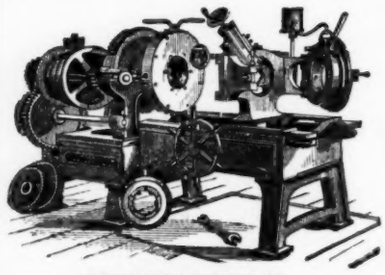

D. SAUNDERS' SONS,

Manufacturers of

Pipe Cutting & Threading Machines

For Pipe, Mill and Steam Fitters' Use.

TAPPING MACHINES,

For Steam Fitting, also

Steam and Gas Fitters' Hand Tools,

21 Atherton St., Yonkers, N. Y.

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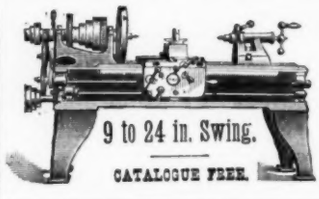

CATALOGUE FREE.

ARE YOU LOOKING

for a lathe? We are building them in various sizes from 9 in. to 24 in. swing, in various lengths, both engine and speed lathes. Our designs are the **latest**, while the **workmanship, material** and **finish** are of the **highest** order. Our catalogue will tell you all about them as well as of our planers, shapers and other tools.

SEBASTIAN LATHE CO.,

117 and 119 CULVERT ST., CINCINNATI, OHIO, U. S. A.

Catalog D tells more about it. FREE.

THE Pans that are used in "HOPPES" Feed Water PURIFIERS Look like the Cut. "Catch on to the shape." They Keep Boilers Clean and free from Scale. The mud can't get away. The scale forms on the underneath surface.

THE HOPPES MFG. CO., Springfield, O.

FINE TAPS

OF EVERY DESCRIPTION.

Manufactured by WELLS BROS. & CO., Greenfield, Mass., U. S. A.

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Do You Want to

SQUEEZE

Something?

We make Squeezers of many kinds, shapes and sizes.

You'd be interested in our Catalog D.

• • •

THE WATSON-STILLMAN COMPANY

212 East 43d Street, NEW YORK.

Concerning the Economy Of Boring Mills Over Lathes For Faceplate Work.

The following letter from Mr. E. E. Davis, assistant superintendent of motive power of the Philadelphia & Reading Railroad, appeared in the June issue of *Locomotive Engineering*, of New York, and needs no explaining to a mechanic :

Mr. E. E. Davis, assistant superintendent of motive power of the Philadelphia & Reading, writes us :

"Since that article on the P. & R. shops in Reading appeared in *Locomotive Engineering*, I have received several letters asking for information regarding the new 37-inch Bullard boring and turning mill recently placed in our Reading shops. As doubtless there are others of your readers who would like to know about the machine, I will use, with your permission, the columns of your paper to inform them.

"If I were to equip a new shop, or select some new tools for an old one, I would certainly have a few boring and turning mills and fewer lathes. I also think that one-half of the work that is now done on a lathe can be done on the mill in from one-third to one-half less time, and be more satisfactory when completed.

"The mechanics in our shops like the mill very well, as it is much more convenient to get the work on and off the table of a mill than it is to fasten it to the faceplate of a lathe. The mill is more rigid than many of the lathes, and two tools can be used on most of the work at one time.

"On work taken from the lathes, such as cylinder heads, eccentrics and eccentric straps, hub liners, etc., there has been a saving of *34 per cent.* Work taken from the slotting machine, such as the ends of driving box brasses, etc., shows a difference in favor of the mill of *61 per cent.* Work taken from the planer, such as facing locomotive slide valves, has been reduced *22 per cent.*"

The

Bullard Machine Tool Co.,

Bridgeport, Conn.

Buyers' Finding List.

Adding Machines.
Grant Calculating Machine Co., Boston, Mass.

Air Compressors.
Ingersoll-Sergeant Drill Co., New York.
Guild & Garrison, Brooklyn, N. Y.
Rand Drill Co., New York.

Asbestos Cement Felting.
Johns Mfg. Co., H. W., New York.

Auger Bits.
Adams, A. L., Bridgeport, Conn.

Balls, Steel.
Cleveland Machine Screw Co., Cleveland, O.

Bearings, Anti-Friction.
Ball Bearing Co., The, Boston, Mass.
Hyatt Roller Bearing Co., Newark, N. J.
Mossberg Mfg. Co., Attleboro, Mass.

Belt Dressing.
Dixon Crucible Co., Joseph, Jersey City, N. J.

Bicycle Tools.
Bickford Drill & Tool Co., Cincinnati, O.
Bliss Co., E. W., Brooklyn, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mach. Screw Co., Cleveland, O.
Davis & Egan Mach. Tool Co., Cincinnati, O.
Ferracute Machine Co., Bridgeton, N. J.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
Niles Tool Works Co., Hamilton, O.
Pratt & Whitney Co., Hartford, Conn.

Blowers.
American Gas Furnace Co., New York.
Buffalo Forge Co., Buffalo, N. Y.
Cooke & Co., New York.
Roots, P. H. & F. M., Connersville, Ind.
Sturtevant Co., B. F., Boston, Mass.

Boilers, Steam.
Weston Engine Co., Painted Post, N. Y.

Bolt Cutters.
Acme Machinery Co., Cleveland, O.
Davis & Egan Machine Tool Co., Cincinnati, O.
Detrick & Harvey Machine Co., Baltimore, Md.
Hill, Clarke & Co., Boston, Mass.
National Machinery Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn.
Reece, Edw. J., Greenfield, Mass.
Sellers & Co., Inc., Wm., Philadelphia, Pa
Strelinger & Co., Chas. A., Detroit, Mich.
Webster & Perks Tool Co., Springfield, O.
Wells Bros. & Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Books.
Audel & Co., Theo., New York.
Baird & Co., Henry Carey, Philadelphia, Pa.
Comstock, Wm. T., New York.
Grant Gear Works, Boston, Mass.
Henley & Co., Norman W., New York.
Strelinger & Co., Chas. A., Detroit, Mich.
Wiley & Sons, John, New York.

Boring and Turning Mills.
Betts Machine Co., Wilmington, Del.
Bickford Drill & Tool Co., Cincinnati, O.
Bullard Machine Tool Co., Bridgeport, Conn.
Davis & Egan Machine Tool Co , Cincinnati, O.
Niles Tool Works Co., Hamilton, O.
Pond Machine Tool Co., The, Plainfield, N. J.
Sellers & Co., Inc., William, Philadelphia, Pa.

Brass Work, Special.
Nolte Brass Co., Springfield, O.

Bushings.
New Process Raw Hide Co., Syracuse, N. Y.

Calipers.
Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Tool Co., Athol, Mass.
Starrett, L. S., Athol, Mass.
Strelinger & Co., Chas. A., Detroit, Mich.
Wilkinson & Co., A. J., Boston, Mass.

Calorimeters.
Schaffer & Budenberg, Brooklyn, N. Y.

Castings, Brass.
Lorain Foundry Co., The, Lorain, Ohio.
Nolte Brass Co., Springfield, O.

Castings, Iron.
Builders Iron Foundry, Providence, R. I.
Burr & Houston Co., Brooklyn, N. Y.
Leland & Faulconer Mfg. Co , Detroit, Mich.
Lorain Foundry Co., The, Lorain, Ohio.
Shriver & Co., T., New York.

Castings, Phosphor Bronze.
Nolte Brass Co., Springfield, O.

Castings, Steel.
Johnson Co , The, Johnstown, Pa.

Cements, Etc.—Fire-proof
Johns Mfg. Co., H. W., New York.

Centering Drill.
Slocomb & Co., J. T., Providence, R. I.

Chucks, Drill.
Almond, T. R., Brooklyn, N. Y.
Cushman Chuck Co., Hartford, Conn.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
Morse Twist Drill & Machine Co , New Bedford, Mass.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt Chuck Co., Clayville, N. Y.
Skinner Chuck Co., New Britain, Conn.
Trump Bros. Machine Co., Wilmington, Del.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Whiton Machine Co., D. E., New London, Conn.

Chucks, Lathe.
Cushman Chuck Co., Hartford, Conn.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
National Chuck Co., New York.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Pratt Chuck Co., Clayville, N. Y.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.

Chucks, Tapping.
National Chuck Co., New York.

Clutches, Friction.
Bliss Co., E. W., Brooklyn, N. Y.
Evans Friction Cone Co., Boston, Mass.
New Haven Mfg. Co., New Haven, Conn.

Condensers.
Conover Mfg. Co., New York.
Guild & Garrison, Brooklyn, N. Y.

Counting Machines.
Durant, W. N., Milwaukee, Wis.

Couplings.
Patterson, Gottfried & Hunter, New York.
Stuart's Foundry and Machine Works, R. J., New Hamburgh, N. Y.

Coverings, Non-conducting Pipe & Boiler.
Johns Mfg Co., H. W., New York.

Cranes.
Maris Bros., Philadelphia, Pa.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Cutting-Off Machines.
Armstrong Mfg. Co., The, Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
Hurlbut-Rogers Mach. Co., So. Sudbury, Mass.

Dies, Screw Cutting.
Acme Machinery Co., Cleveland, O.
Besly & Co., Chas. H., Chicago, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Jones & Lamson Machine Co., Springfield, Vt.
Montgomery & Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Strelinger & Co., Chas. A., Detroit, Mich.
Taylor-Rice Engineering Co., Gloucester City, N. J.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Drawing Instruments, Etc.
Alteneder & Sons, T., Phila[illegible]a, Pa.
Keuffell & Esser Co., New [illegible]

Drilling Compound.
Peerless Drilling Compound [illegible] The, Utica, N. Y.

Drilling Machines.
Adt & Son, John, New Haven, Conn.
Aurora Tool Works, Aurora, Ind.
Barnes Co., W. F. & John, Rockford, Ill.
Betts Machine Co., Wilmington, Del.
Bickford Drill & Tool Co., Cincinnati, O.
Blaisdell & Co., P., Worcester, Mass.
Dallett & Co., Thos. H., Philadelphia, Pa.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dietz, Schumacher & Boye, Cincinnati, O.
Fitchburg Machine Works, Fitchburg, Mass.
Foote Barker & Co. Cleveland, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Montgomery & Co., New York.
Mossberg Mfg. Co., Attleboro, Mass.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pond Machine Tool Co., The, Plainfield, N. J.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Quint, A. D., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Sibley & Ware, South Bend, Ind.
Strelinger & Co., Chas. A., Detroit, Mich.
Timolat, J. G., New York.
Warner & Swasey, Cleveland, O.
Wilkinson & Co., A. J , Boston, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Drill Gage.
Wyke & Co., J., East Boston, Mass.

Drill Rods.
Abbott, Wheelock & Co., Boston, Mass.

Drills, Twist.
Besly & Co., Chas. H., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Machinists' Supply Co., Chicago, Ill.
McFadden Co., Philadelphia, Pa.
Montgomery & Co., New York.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Syracuse Twist Drill Co., Syracuse, N. Y.

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Transue & Williams, Alliance, O.
Wyman & Gordon, Worcester, Mass.

Dynamos.
Crocker-Wheeler Electric Co., New York.
General Electric Co., New York.
Roth Bros. & Co., Chicago, Ill.

Dynamo Brushes.
Wirt, Charles, Philadelphia, Pa.

Electric Machinery.
Crocker-Wheeler Electric Co., New York.
General Electric Co., New York.

Elevators.
Albro-Clem Elevator Co., Philadelphia, Pa.

Emery Wheel Dresser.
Wrigley, T., Chicago, Ill.

Emery Wheels.
Besly & Co., Chas. H., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
Montgomery & Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Sterling Emery Wheel Co., Tiffin, O.
Strelinger & Co., Chas. A., Detroit, Mich.

Engines, Gas and Gasoline.
Norman Co., J. J., Chicago, Ill.
Otto Gas Engine Works, Philadelphia, Pa.
Pierce Engine Co., Racine, Wis.
Springfield Gas Engine Co., Springfield, O.
Webster Manufacturing Co., Chicago, Ill.

Engines, Steam.
Ames Iron Works, Oswego, N. Y.
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Forbes & Co., W. D., Hoboken, N. J.
Frick Co., The, Waynesboro, Pa.
Greenfield, W. G. & G., East Newark, N. J.
Keystone Engine & Mach. Works, Phila., Pa.
Sturtevant Co., B. F., Boston, Mass.
Weston Engine Co., Painted Post, N. Y.
Wetherill Machine Co., James P., Chester, Pa.

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Hoppes Mfg. Co., Springfield, O.
National Pipe Bending Co., New Haven, Conn.
Taunton Locomotive Mfg. Co., Taunton, Mass.

Files.
Arcade File Works, New York.
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Machinists' Supply Co., Chicago, Ill.
McFadden Co., Philadelphia, Pa.
Montgomery & Co., New York.
Nicholson File Co., Providence, R. I.
Reynolds Bros., Columbus, O.
Strelinger & Co., Chas. A., Detroit, Mich.

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Wilkinson Co., The, Chicago, Ill.

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Evans Friction Cone Co., Boston, Mass.

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Coffin & Leighton, Syracuse, N. Y.
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Taylor-Rice Engineering Co., Gloucester City, N. J.
Wyke & Co., J., East Boston, Mass.

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Schaffer & Budenberg, Brooklyn, N. Y.

Gear Cutters.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Whiton Mach. Co., D. E., New London, Conn.

Gears.
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Boston Gear Works, Boston, Mass.
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Grant Gear Works, Boston, Mass.
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Governors.
Replogle Governor Works, The, Akron, O.

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Dixon Crucible Co., Joseph, Jersey City, N. J.

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Leland & Faulconer Mfg. Co., Detroit, Mich.
Norton Emery Wheel Co., Worcester, Mass.
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Strelinger & Co., Chas. A., Detroit, Mich.
Wells Bros. & Co., Greenfield, Mass.

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Davis & Egan Machine Tool Co., The, Cincinnati, O.
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Garvin Machine Co., New York.
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Pratt & Whitney Co., Hartford, Conn.

Grinding Machines, Universal.
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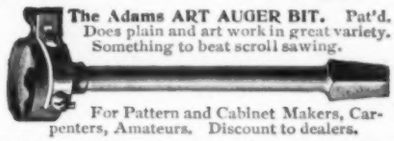
(Continued on page 12.)



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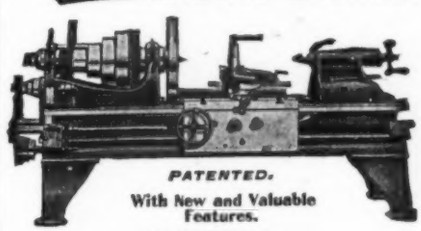

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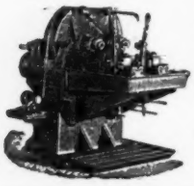

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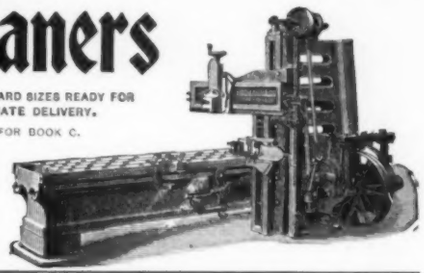

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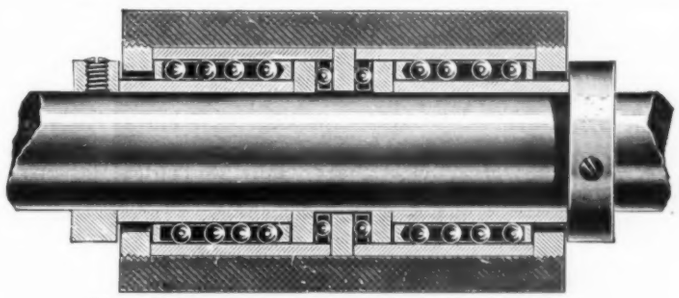

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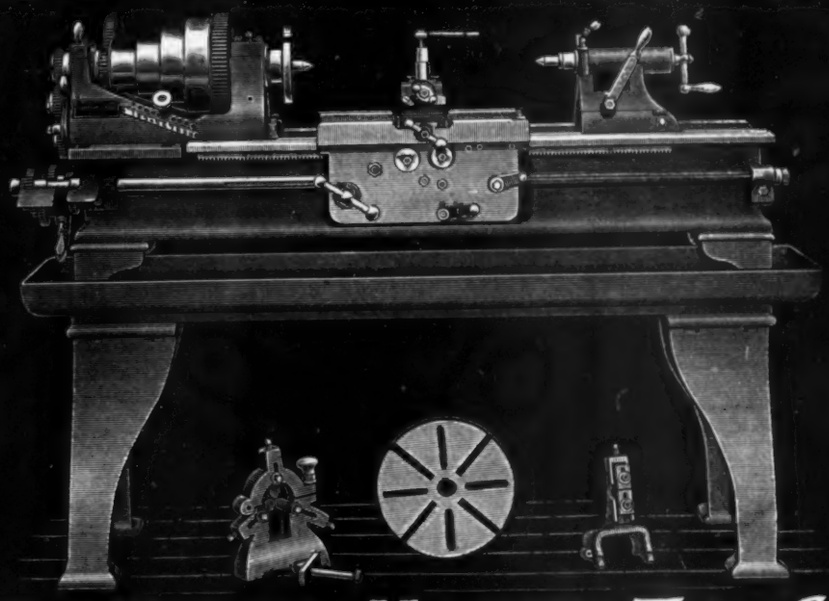

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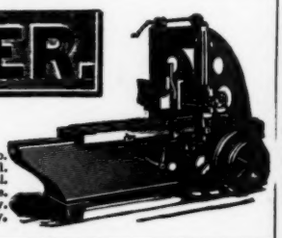

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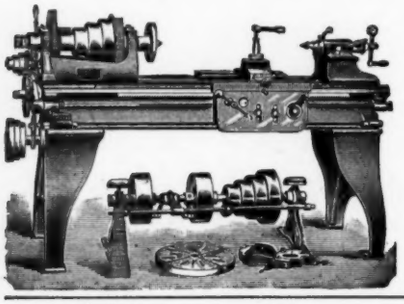

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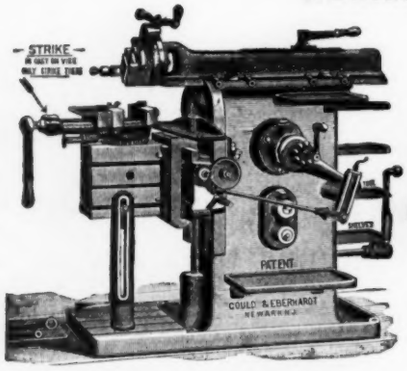

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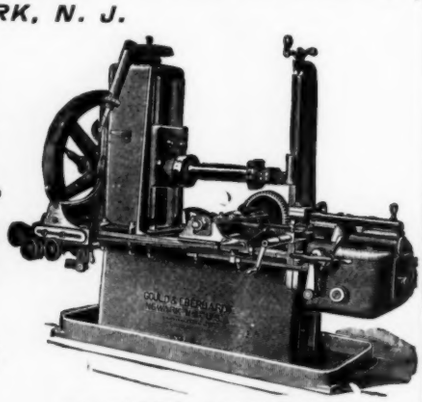

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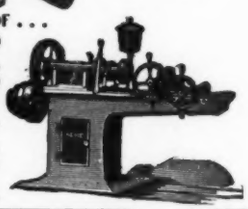

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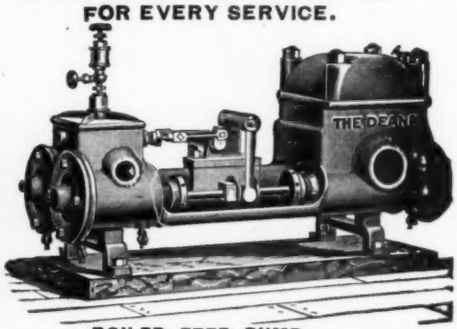

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▲ ▲ ▲

NEW YORK, THURSDAY, AUGUST 6, 1896.

VOLUME 19. ▲ ▲ ▲ NUMBER 32.

Quick-Opening Throttle Valves.

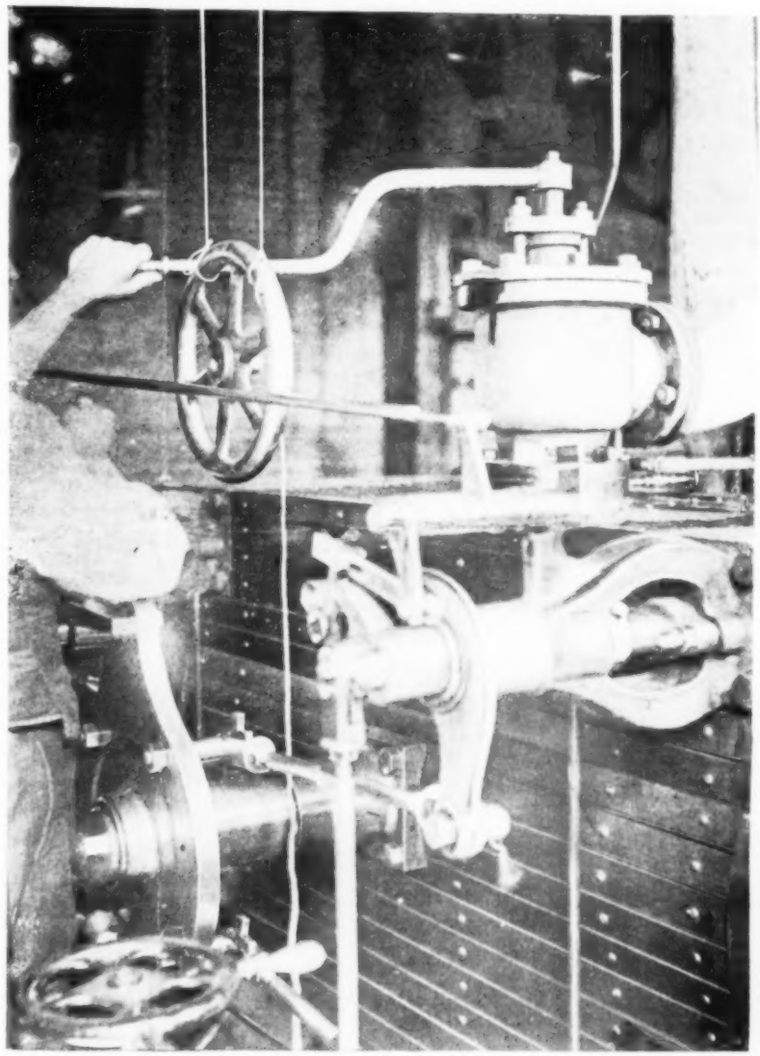
BY PETER H. BULLOCK.

Perhaps there are no other parts or appliances pertaining to stationary steam engines about which there is so much uniformity of shape and style as the throttle valves usually furnished with them. There are now before me the catalogs of eleven engine builders, and the feature of the throttle could be interchanged in most of them, about the only noticeable difference being in the length of the stem and style of yoke. There are a few, however, whose designers have broken away from the stereotyped style and show some specially arranged or lever-operated valve.

Although it is usually good practice to operate a throttle valve slowly, there does not seem to be any necessity that its construction should be such that it cannot be operated quickly in case of emergency. In other words, the fact that a valve can be opened quickly should not be considered as an excuse for any lack of judgment in that direction. On the contrary, it should be possible to perform quickly any function about an engine that it is necessary to do at all.

Two out of four fly-wheel accidents within the past few years, the circumstances of which were carefully looked into by the writer, might, and in his judgment probably would, have been averted, had the means been at hand to have very quickly closed the throttle valves of the engines. Eight and ten-inch throttles, as made by most engine builders, require from eight to sixteen turns of the wheel to fully open them, depending upon whether the valve is a globe or angle and upon the pitch of the screw. It can be said to the credit of the builders that these valves are usually well made, even if there is an utter lack of originality in their design. The stem is usually of a length sufficient to bring the wheel more or less convenient to the hand when at the starting bar, except in cases where the regulator rods are in the way.

Some six months ago I saw in an old paper a cut of a lever-operated throttle, and wrote to the address given for prices and particulars. The letter was returned covered with post-official hieroglyphics, asserting that the parties were not to be found. I saw the same cut soon after in an "omnibus" catalog (I have deliberately adopted this prefix as most adequately describing the literary productions issued by some dealers whose actual stock is usually found to be in inverse proportion to the size of their catalogs. I have such a one before me now, containing 678 pages, and it would require Madison Square Garden to properly exhibit the goods illustrated. As a matter of rental economy, however, the firm carries on business in a store and basement (60 x 20) and ordered one by name and number. After some weeks I received the valve, and traced its genealogy by means of the shipping tags and express pasters until I was able to identify the makers and the locality where it came from. When I put the mystical "O. K." on the bill I realized that each trans-shipment and nominal possession by agents had materially increased the total amount by several per cent. Since that time I have opened more direct connections with the makers, and now have several in use and they are doing well. The makers, how-



A QUICK OPENING THROTTLE VALVE.

ever, so far as I know, do not introduce any special features of style or shape to better adapt them for the different places and positions for which they may be wanted.

In order to show the position of the lever in relation to the other parts of a Corliss engine, the accompanying half-tone is shown. The valve is closed, the lever being in easy position to be grasped by the left hand while the right is free to work the starting bar or injection gate. When the valve is open, the lever swings about as much to the right as it is now shown to the left. The first movement of the lever opens an auxiliary on top of the main valve, thereby relieving in part the pressure and making it easier to operate. The throttle which this replaced was a good substantial affair, made by G. H. Corliss, the most objectionable feature being that the wheel was located just behind the longest regulator rod, and over or under which one had to reach and turn ten times in order to open or close it. In the cut the wheel is shown suspended in exactly the position it formerly occupied.

If anyone sees any beauty in the graceful curves of the lever, I will blushingly acknowledge the compliment, as it was made by myself to take the place of a shorter and rather plain one furnished by the makers.

▲ ▲ ▲

Bicycle Tools—XXIX.

The construction and finishing of the bicycle frame, including the consideration of stampings, castings in malleable iron or mitis metal, and drop-forgings for the joints and crank-hanger, brazing fires, spelters, pinning drills and pickles, the sand blast and filing and truing fixtures and tools and polishing means and methods, would, if treated at such length as to fully cover the subject in all its branches, make a book of respectable size; indeed, if this book included, as it properly might, frame tube making machinery, the book of the cycle frame would become a bulky volume, and even then would demand an extensive appendix to represent wood cycle frame construction and the one-piece casting in which the frame is poured from that unspecified alloy given the trade name of "Luminum," and said to contain 94 per cent. of aluminum, and to be, weight for weight, considerably stronger than steel. Obviously, no comprehensive effort of such magnitude could be printed in these columns; the most that can be done is to give selections from the best practice, leaving varied aspects of the subject to be treated piecemeal in the future, under separate headings.

The first cycles had wooden frames, which quickly gave way to solid wrought-iron forgings, succeeded by wrought-iron pipe welded up, which in turn was displaced by the structure of drawn-steel tubing with brazed joinings, which is now commonly regarded as the final possibility of excellence in cycle-frame construction.

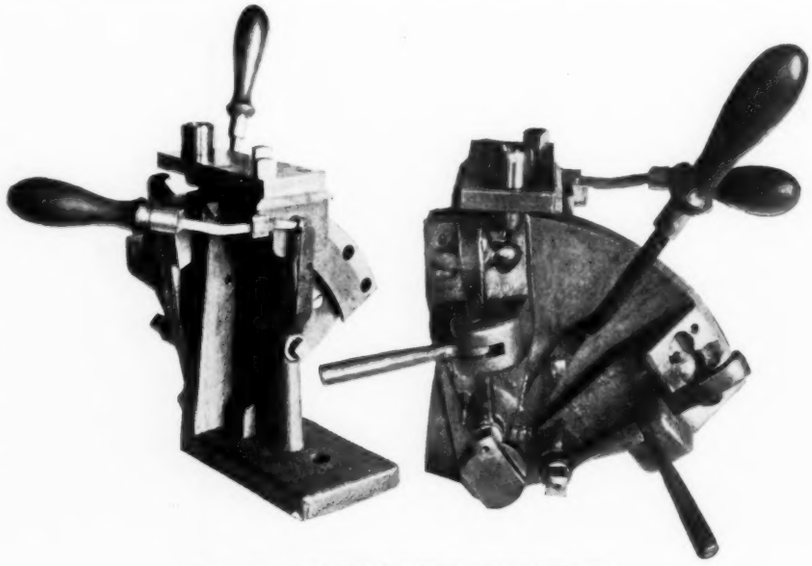


Fig. 185. WESTERN WHEEL TIP-OVER JIG.

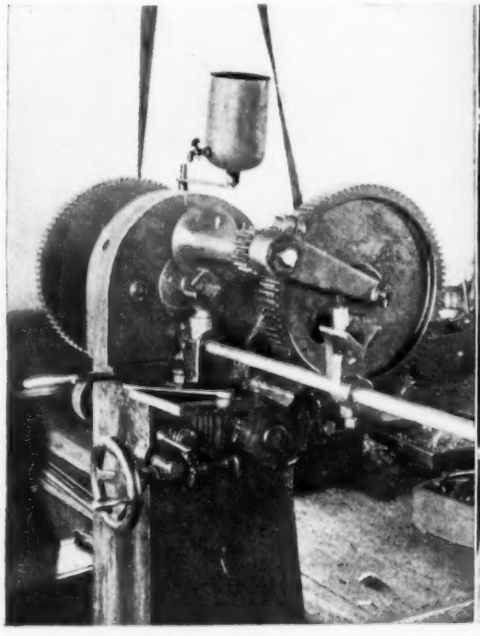


Fig. 187. TUBE MILLING MACHINE—STIRLING SHOPS.

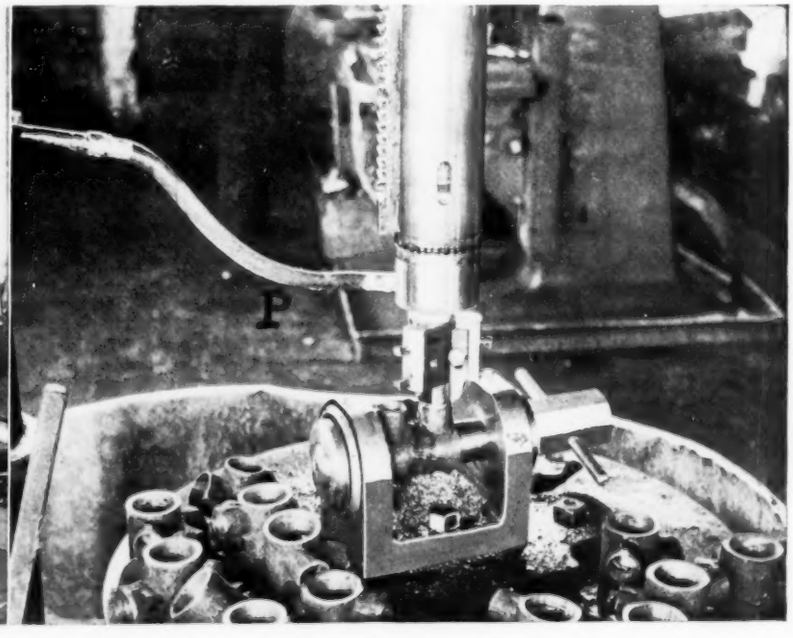


Fig. 186. JOINT NIPPLE HOLLOW MILLING—LOZIER SHOPS.

Serious efforts are being made to establish the fitness of wood as the material of the entire cycle frame. A wooden tube 1¼ inches outside diameter by ¾ inch inside diameter is said to be much

stronger in every way than a steel tube of the same diameter and equal weight, and it is also claimed by the advocates of the wooden cycle frame that round solid staves of our best American hickory, either "laminated" or natural growth, offer far more resistance to those strains which the cycle frame must encounter than the same weight, extent and diameter of steel tubing. I am not aware that any authoritative tests supporting these assertions as to the relative strength of wooden and steel-tubing cycle frames have ever been made; I do know, however, that wood frame cycles of ordinary weights have successfully endured hundreds of miles of rough road riding, and that the strength and stability of the wood frame are not questioned even by the steel-tube frame makers.

"Steel tube" is not a term of closely defined specification. It may mean in cycle construction anything from a seamless tube drawn in the most careful manner from planchets of the most suitable compound of pure iron and carbon, by the most perfect machinery and best labor which money can buy, or it may mean strips of very inferior sheet "steel" rolled and locked more or less ingeniously and substantially, to form a more or less perfectly round hollow piece which can be brazed together into the similitude of a serviceable cycle frame. There are "cheap" cycles on sale which are a disgrace to all concerned and would be a misfortune to the recipient if they were given away, and the frame of a poorly-made cycle is commonly "scamped" to the last degree of dishonest production.

Passing all the variations of tubing, the question of frame "joints" is the next important matter. Joints are divided broadly into the two classes of "stamped" and "solid" construction. The stamped joints are made of sheet steel, cut and formed by repeated press operations, with annealing to follow each pass, except the last, through the dies, in the best practice. These joints vary greatly in quality, according to the honesty and skill and ingenuity of their makers. The best stamped joints are fine examples of sheet-metal shaping, and while somewhat cheaper than the best solid joints, stamped joints can be safely classed as component parts of highest grade cycles.

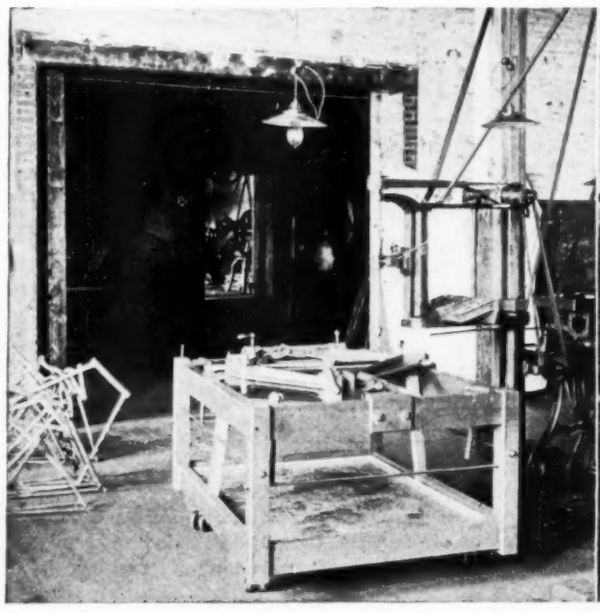


Fig. 189. COLUMBIA FRAME-PINNING RIG.

Fig. 190. LOZIER FRAME-PINNING RIG.

Fig. 192. LOZIER FRAME FILING.

Solid joints are made of malleable iron castings, steel castings, mitis metal castings and drop-forgings. Mitis metal is quite well known as giving the nearest approach to steel forgings in the form of castings, and is regarded as much superior to cast malleable iron.

The solid joint is brought as nearly as possible to outside finished shape in the original casting or drop-forging, and is reduced to a very thin shell by drilling and reaming internally in jigs, which often hold the joint for the first drilling in screw-adjusted cups, which grasp and center the joint by the circumferential edges of its circular ends. At the Western Wheel shops, Chicago, a double, "tip-over" jig is largely used, shown in Fig. 185. The work-holding piece of this jig has two work-holders, vibrates on a pivot and can be latched in two positions, so that while one piece is being drilled the other work-holder can be cleaned and have a piece put in it ready to tip up under the drill guide and be worked, while the first-used work-holder is being emptied and filled anew. This tip-over jig is regarded as a very valuable time-saver at the Western Wheel, where labor is closely watched.

Joints are finished outside by turning in the lathe, hollow milling, form milling and filing. Fig. 186 shows a hollow pin-mill with a single inserted tooth or cutting tool, lately put in very satisfactory use at the Lozier Toledo shops, shown at work in an upright drill spindle. Flooded lubrication through pipe *P*.

The tube is cut to length in a great variety of machines; some special, as in Fig. 187, from the Stirling shops, or in the form of drill press attachments, one of these made by Perkins, of Grand Rapids, Mich. In the Perkins tube cutter the tube is laid on the two rollers, to an end gage for length, and is cut by the revolving, plain-edged circular knife seen over the rolls, the knife or cutter

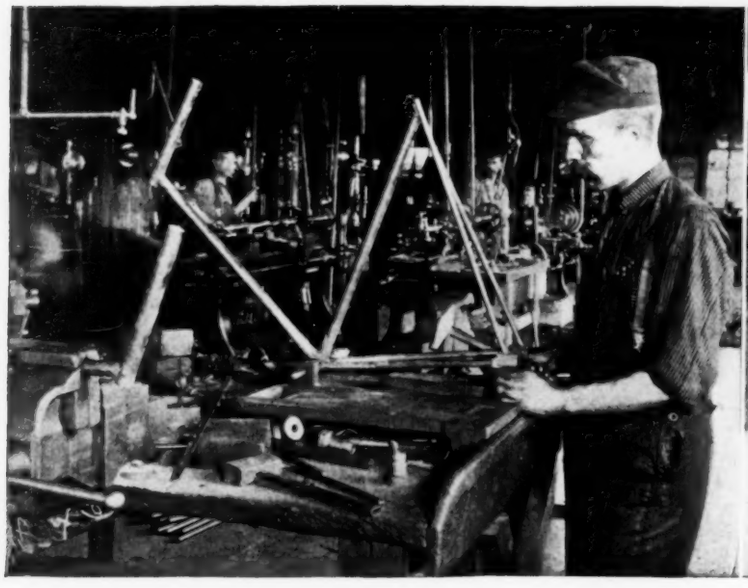


Fig. 191. INTERMEDIATE FRAME-TRUING—G. & J. SHOPS.

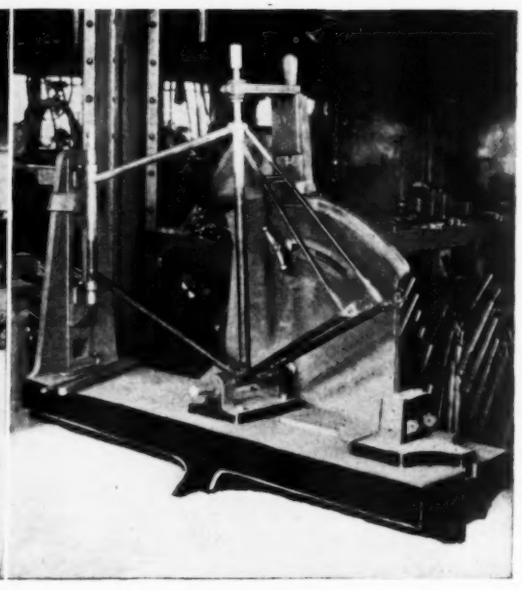


Fig. 193. FRAME-TRUING FIXTURE—G. & J. SHOPS.

arbor carrying at one end a fluted reamer for burring the inside of the cut tubes, and at the other end a face mill, with a guiding stem to go inside the cut tube, so that with this cheap little affair in an upright drill press, frame tubes can be very rapidly cut off, burred and squared up. This device was illustrated and described on page 431.

In some shops the parts of the entire frame are assembled in a jig which holds them securely together in correct position while pin-holes are drilled through the joints and tubes and wire pins are driven therein, so that the frame parts are well held together while the joints are successively brazed. Such jigs are shown in Fig. 189, from the Columbia shops, and Fig. 190, from the Lozier factory. The Columbia frame assembling jig is on

Fig. 196. TUBE TRUING—LOZIER SHOPS.

top of a wheeled table served by a stationary drill spindle; the Lozier jig is stationary, and the pin-drill spindle is rendered universally traversing by carrying it at the free end of two vertically-jointed, horizontally-vibrating drill arm members, all as clearly shown in the engraving, this being a very easily managed and satisfactory arrangement of jig and drill.

In some shops the frame is brazed up in sections, with intermediate truing operations, as shown in Fig. 191, from the Gormully & Jeffery shops. It is quite obvious that it may save severe adjusting strains in the final truing-up if partial assemblings of frame sections are brazed up and trued separately. This partial method of assembling means also partial finishing, which is in many cases more easily performed on a frame section than

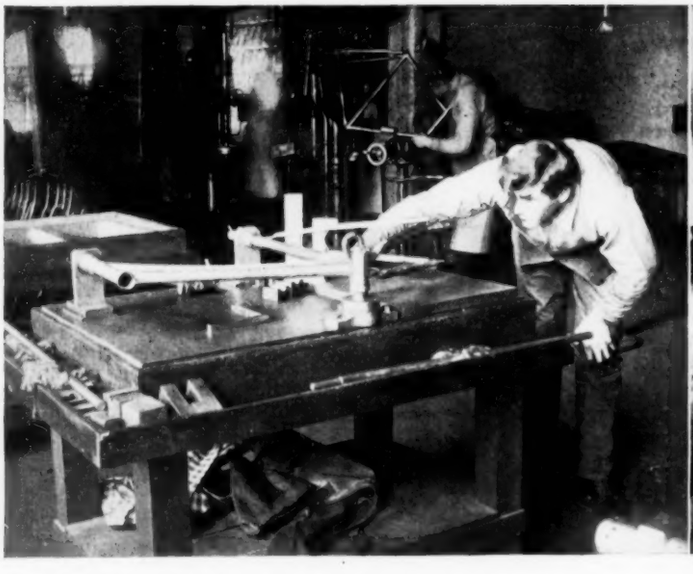


Fig. 194. LOZIER FRAME-TRUING FIXTURE.

Fig. 195. G. & J. FORK-TRUING FIXTURE.

if the same piece were to be filed up after it was in the completed frame.

Brazing and the sandblast will be treated separately, as brazing will not bear a condensed treatment. The frames come finally from the sandblast or brazing pickle tub to the frame filer. In the Columbia the frame filers work on rows of common vises on closely placed benches running across the room; in many shops the frame filers work at common vises on benches next the windows. In one or two instances the filers are put on benches running fifteen or twenty feet into the room, at right angles to the regular wall bench; this is a convenient arrangement for gangs, who thus occupy three sides of a hollow square about their common work floor. The Lozier frame-filing floor vise and file stand, with workman, is shown in Fig. 192. A row of independently supported vises is placed about ten feet back of the side-wall vise benches, and gives each workman plenty of room and easy working postures for all difficult-to-reach surfaces of the assembled frame.

After filing, the frames go to the truing jig or fixture or table, which is alike in no two shops, so far as I have seen. Fig. 193 shows the Gormully & Jeffery frame-truing fixture, which may be taken as a type of the vertical form of this tool, while the "Columbia" employs the most elaborate and costly form I have seen. My photograph of the "Columbia" frame-truing fixtures is on too small a scale to reproduce effectively; they are magnificently built, stand on individual iron tables, and are beautiful examples of art in tool-making. The Lozier departs from the usual vertical form of frame-truing jig, and takes the surface plate for a basis, as shown in Fig. 194. This form gives facilities for the ready use of the square and surface gage, and enables the frame adjuster to test every line of the frame with ease. Frame-adjusting is generally very carefully and faithfully performed, as frame variations lead to vexatious delays in assembling, and it is a rare thing for a very imperfect alignment of frame members to leave the truing fixture. I noticed invariably, however, that the best shops true frames with the most care, the workmen never passing a frame until the gages slip in and out of place with perfect freedom.

Fig. 195 shows the front fork truing fixture used in the Gormully & Jeffery shops, and Fig. 196 shows the method by which a tube not perfectly circular is brought to correct shape in the same shops. Two hard maple blocks having hollows accurately bored in the lathe to exactly the outside size of the tube to be rounded up, are put in the vise as shown, embracing the tube distortion, and the frame is then rocked back and forth through a convenient arc of vibration; the vise is closed so as to make the tube turn pretty hard, and it heats very rapidly, and a very considerable dent or flattening of the tube disappears in a surprisingly short time under this simple "movement cure" treatment.

HUGH DOLNAR.

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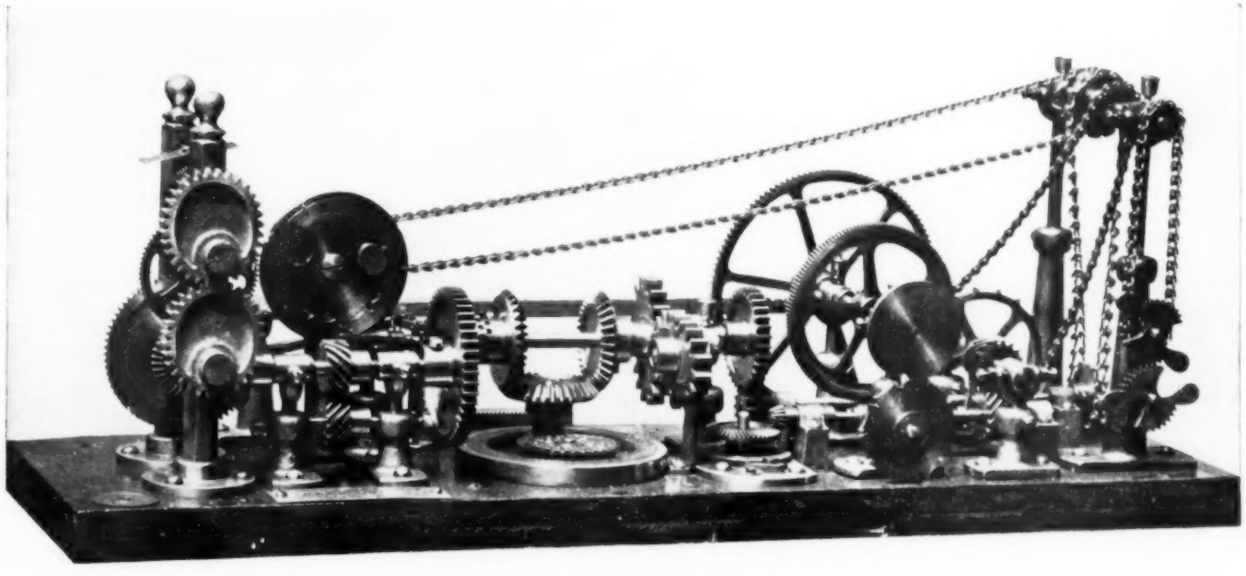
A Collection of Gearing.

The engraving presented herewith shows a collection of gearing made by the Boston Gear Works for exhibition purposes primarily, but which is, at the same time, useful as a sample collection and to illustrate various motions obtainable by gearing. The group contains nearly every style of gear that is in common use and many styles not usually seen.

The vertical shaft at the center of the machine, with miter gear attached, is driven underneath by worm gear and worm which are not shown in cut. This miter gear drives two similar gears as shown, and, passing to the right, there is a pair of oval gears with shafts in the centers, giving an acceleration and retardation alternately in each half revolution. The spur gear next to the right drives the pinion below, which is on the end of a shaft passing through to the extreme right, when it drives the sprocket wheels above by means of a chain running "quarter twist."

At the right of the previously mentioned spur gears are seen a worm wheel and worm, intermittent spur gear, a pair of helical gears on shaft at right angles to each other, and, finally, a pair of special gears with teeth of widely varying pitches, by which a very peculiar motion is obtained.



A COLLECTION OF GEARS.

At the left of the vertical shaft and miter gears are seen helical gears on parallel shafts, internal intermittent wheel and pinion, elliptical gears, and train of spur wheels with fan regulator.

▲ ▲ ▲

Probably no great scientific discovery was ever so quickly put to practical use as that of the "X-rays." Apparatus for developing and utilizing these rays are now regularly manufactured for use in surgery, and it is reported that the British War Office has supplied the surgeons of the Nile campaign with the apparatus. Scientists are as far as ever, apparently, from a knowledge of just what these rays are. The name is a manifestation of this ignorance. In algebra, x stands for the unknown quantity, and the name "X-ray" simply means that the nature of the rays is unknown. "What-is-it-ray" would express the same idea.

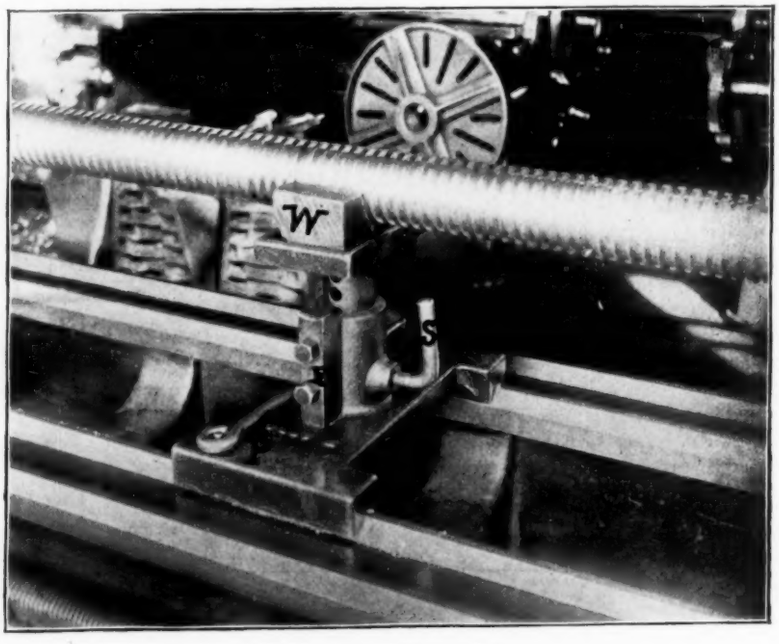
Lathe Work Support.

BY JOHN RANDOL.

The engraving shows very clearly a support for long lathe work photographed from the Pond shops, Plainfield, N. J.

This adjustable work support was devised by Mr. Isaac E. Houston, who has for many years made the long screws at the Pond shops, and it was made to meet the requirements of his own daily work. As all lathe hands who make long slender pieces well know, such work must be supported at frequent intervals, and the supports should be so devised as to be easily and quickly moved to various positions on the ways and so as to be quickly adjusted to the correct height, and should also stay in place after they are put where they are wanted.

This support consists of a saddle fitted to slide on the inside V's of the lathe bed, having a bored upright fitted with a hand clamping screw *S*. To the bore in the upright of the little saddle the round shank of a flanged block-carrying table is fitted to slide; the round shank is flattened on the side next to the hand screw, and the flat is made wider at the bottom than at the top, so as to tighten up on the screw if it slides down, which makes it stay in one place with only an easy turn on the holding screw *S*. The flat top of the table which carries the wooden block *W* is flanged or has a raised border all around it, so that the hollowed wooden block which supports the work cannot slip out of place, or, as might happen when supporting a long screw as shown in the picture, be screwed out of place by the revolution of the work.



LATHE-WORK SUPPORT.

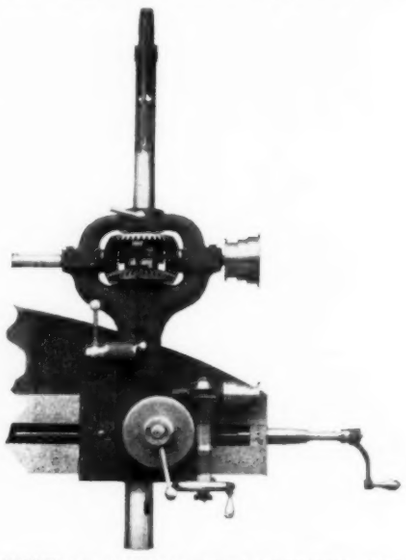
To make it easy to lift the wood block *W* just as high as it needs to be, round holes are drilled in the front side of the table shank, and a long lifting pin *P* is provided to fit those holes at the end and be used as a lever across the fulcrum *F*, screwed to the front side of the upright on the saddle; the top of the fulcrum is lightly hollowed out to keep the pin from sliding off. Long work of this kind is commonly supported in a very uncertain manner by piling up wooden blocks on the lathe V's, and when work is so supported it is always liable to wiggle the wood blocks out of place.

The fulcrum block was an afterthought, and might well have been made a part of the original saddle casting instead of batting on afterward.

The lifting pin has an eye at the front end, which surrounds a stud in the saddle when not in use, the back end lying between two other studs, all cast on the top of the saddle, so that the lifting pin will not jar off the saddle when not in use. I think there were three or four of these supports under the very long feed screw which Mr. Houston had in the lathe when the picture was taken, and perhaps half a dozen such supports would be enough for a shop. They might be made to fit any lathe by having only the front member of the saddle V'd on the bottom, and leaving the back end flat to sit on top of the back V. As they would generally be most used on one or two lathes in a shop only, perhaps it is better to fit them on both V's, as Mr. Houston has done. Either way the "Houston lathe work support" is worth remembering and worth copying wherever long, slender rods, shafts and screws are often put in the lathe.

Radial Drill with Reverse Motion for Tapping.

In our issue of July 5, 1894, we illustrated and described a radial drill made by Wm. E. Gang & Co., of Cincinnati, and we give herewith an engraving of so much of the machine as is necessary to show the new arrangement of gearing by by which the motion of the spindle is reversed when used for tapping. A double-end clutch is used, which is thrown by the short lever seen in front of the saddle at the left.



REVERSE MOTION ARRANGEMENT FOR RADIAL DRILLS.

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Rope-Driving Arrangements.

One of the technical papers which has discussed the question of rope-driving as applied to electrical work, draws attention to a claim made by the upholders of direct connection, that for dynamos exposed to great and sudden variation of effort, the elasticity of the ropes tends to cause them to assume a wave line on the slack side, which tends to throw the ropes off the driven pulley. There would appear to be a twofold reason for this: First, a want of sufficient stored mechanical energy in the dynamo itself. On a sudden accession of load the revolving armature is quickly brought to rest, or tends to be so, and it must make a big demand upon the ropes. In fact, the energy of the engine fly-wheel is communicated through the ropes to the dynamo. This is not as it should be; there should be a fly-wheel on the spindle of the dynamo to yield up its stored energy as soon as the armature is exposed to extra stress. But apart from this action there is the second cause, viz., unsuitable arrangement of ropes. My own experience is that in the majority of cases of rope-driving, outside the textile districts, things are so arranged that the lower or driving side of the ropes is horizontal, or nearly so, and the slack side slopes down toward the driven pulley.

Now let this action be traced to its conclusion. We will suppose a 28-foot drum and a 6-foot driven pulley, with the ropes horizontal on the driving side. Let the distance apart of the pulleys at the crown be 50 feet. Take the rope speed as 80 feet per second. Then it will require five-eighths of one second for the rope to travel from rim to rim. Under the force of gravity a rope will fall about 6 feet in this time. But the rope has got to fall 22 feet, and it follows therefore that the tendency of the rope as it comes to the intermediate crown of the big drum is to travel so as to land at a height of 16 feet (or 22 — 6 = 16) above the top of the driven pulley. Now, when the rope is suddenly made very slack there is length on the slack side for a wave to be thrown into the rope. This wave is readily formed in an upward curve by the centrifugal tendency of the rope as it comes over the big drum, and the wave tries to travel forward horizontally. As we have seen, gravity hauls it 6 feet lower before it reaches the driven pulley; but of what use is this when the energy of the wave still keeps it up and there is yet another 16 feet to be accounted for by gravity? I do not, of course, mean to imply that the wave is 16 feet high, but simply that the rope inertia, if uncontrolled by the tension, would account for such a position, and that gravity is shown not to be equal to the task of reducing an upward wave to a hollow.

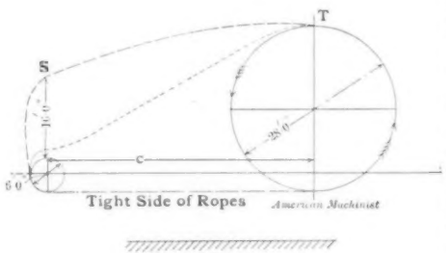

Fig. 1

BAD PRACTICE.

Let us now consider a better design. We will put the dynamo up and keep the engine lower down, so that the rim of the driven pulley at the crown is only 2 feet lower than the driving rim. We shall now perceive that any wave coming over the driving rim will be hauled down by gravity a distance of 6 feet, or to 4 feet below the rim of the smaller pulley. The accompanying figures will perhaps explain my meaning more fully.

In Fig. 1 the upper dotted line may be taken as showing possibly where a sufficiently slack rope would actually place itself 16 feet above the lower pulley. It could not be higher than this unless it left the large pulley well before it had travelled as far as the crown. The 16-foot position is that assumed where the rope just gets free of the groove at the top of the vertical diameter at *T*. The lower line shows how in actual practice the rope really behaves, being kept so far under control by its tightness; but there is still the throw over the small pulley.

Take now Fig. 2, when the conditions are reversed. The rope will still fall 6 feet in the course of its journey, but in so doing it will, if slack enough, reach the position of the dotted line marked *n*. If tighter, it would take the curve *m;* but its tendency will be towards *n* and towards running into the face of the driven pulley, as shown, the extra slackness actually going to increase the grip arc on this pulley when it is most required, or just the opposite from the mischievous action of Fig. 1, which is the usual way and the wrong one.

Gravity is cheap; why not utilize it? We spend much in overcoming it and in counteracting its efforts. In the case of driving ropes and belts we can compel two pernicious influences to become our aids, for we can utilize gravity to eliminate the nasty throw of the rope wave, and we can use the centrifugal tendency of the rope to pull it out of the grooves. Now, in Fig. 1, centrifugal action does this, but it makes the wave. In Fig. 2, with ordinary rope tightness, centrifugal action does its proper work, and gravity preserves the rope in a falling curve—not in a rising one.

In cotton mill work, where the various ropes from the large drum are led off to the pulleys in the first, second, third, fourth and perhaps fifth floors, one may trace the different forms assumed by the ropes, and it may often be noticed when the high ascending ropes hang steadily on the slack side and run right into the face of the driven pulleys, the ropes to the lower room have a waving motion and are evidently not hanging in what I would term a gravity curve, but are floating along as high as the tension will admit them to rise. Exactly the same action is to be seen, of course, in belts, and these appear to float downward when the driven pulley is low, and there is much flapping and cracking, and imprisoned air is blamed for it, whereas it is the upward tendency of the belt that imprisons the air, and with proper arrangement the belt would curve into the face of the pulley just as ropes do. In my opinion, where the driven pulley must be placed low, I think I would as soon work so that the lower or horizontal side of the ropes were the slack sides. Thus, in Fig. 1, I would reverse the direction of rotation rather than have so severe a drop as 16 feet not provided for by gravity.

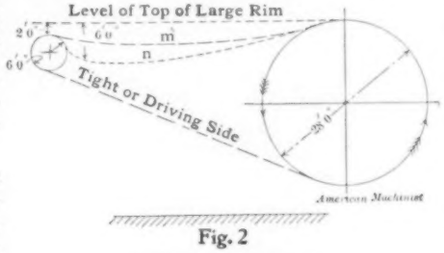

Fig. 2

THE BETTER WAY.

Where a wave, as in Fig. 1, envelopes the whole of the circumference of the smaller pulley, as it might do when the circumstances were favorable to its so doing, there would be a sudden stoppage of the grip upon this pulley, the two sides of the rope would assume the same tension, and the rope, relieved of work, would shorten. The driven pulley would thus be driven by a series of jerks, the ropes alternately stretching and shrinking, slipping and gripping, and producing severe shocks. That some such action, more or less severe, does occur I am persuaded, and undoubtedly it has given rise to much of the truoble with rope driving; but the fault has been with the designers, not with the materials. Anyone who has such a badly designed gear in charge might do worse than use ropes of the minimum of extensibility, for an absolutely inextensible rope once put on tight could not run to waves on the slack side. But the remedy is clearly in good design.

If, in Fig. 1, the speed of the ropes were reduced to 40 feet per second, it would then require 1¼ seconds to travel the distance between the pulley crowns. In 1¼ seconds a rope will fall 16 × $\frac{25}{16}$ (*i. e.*, 16 feet × 1¼ × 1¼), or 25 feet, and Fig. 1 would be nearly as good a design for a rope drive at 40 feet velocity as Fig. 2 is for a velocity of 80 feet, for in each case the rope would tend to arrive below the crown of the small pulley in Fig. 1, say, 3 feet as against 4 feet in Fig. 2.

It is an easy matter to calculate the position towards which a free rope aims. There are given the distance apart of the pulley crowns and the speed of the ropes. This enables the time of flight from *T* to *S* to be determined. Gravity pulls a body down $t^2 \times 16$ feet when *t* is the time in seconds. Thus, in half a second the fall from horizontal is 16 × ½ × ½, or four feet. In 2 seconds it is 64 feet. In 1¼ seconds it is 25 feet. Now, 1¼ is just double the time originally found for Fig 1 at the 80-foot speed. If, therefore, in Fig. 1 we double the distance between the pulley centers, we shall secure a fall of 25 feet and render the arrangement safer, though such a length implies a good deal of slack in the ropes when stretched.

Clearly, a design is a matter in which there may be a good deal of compromise between height, speed and distance. In Fig. 1, for example, if we are tied to the relative pulley centers we might reduce the drum diameters to, say, 18 feet and 4 feet. This would reduce the difference of crown level by 4 feet, and it would reduce the speed of ropes to about 54 feet per second. The total drop would be 22 — 4, or 18 feet, and the gravity drop would be nearly 16 feet, so that, though not right, there would be an improvement of 14 feet in the position the free rope would tend to take above the driven pulley. At 54 feet per second a rope is little, if any, inferior to one at 80 feet, and some engineers would say that the saving of friction wear and tear would compensate for the small

reduction of efficiency—small, because the centrifugal tension at 80 feet has already gone beyond the benefit accruing from further velocity. Starting out with the basis of Fig. 1, we might reduce and lower the large drum, raise the small drum and lengthen the line *c*. In practice it happens that the ropes get made tighter; this can only be a remedy so far as the tightness is such as to pull the ropes into a downward direction as they come over the large drum, and it is a clumsy and wasteful method of endeavoring to cover bad design. Yet the good design is so small, and the utilization of gravity so entirely rational!

W. H. Booth.

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It is reported that there is a surplus of bicycles in the country this season, many of which are being exported to England, and that their effect has been quite perceptible on the market there, and, in fact, has broken it to some extent. American competition is becoming a feature over there.

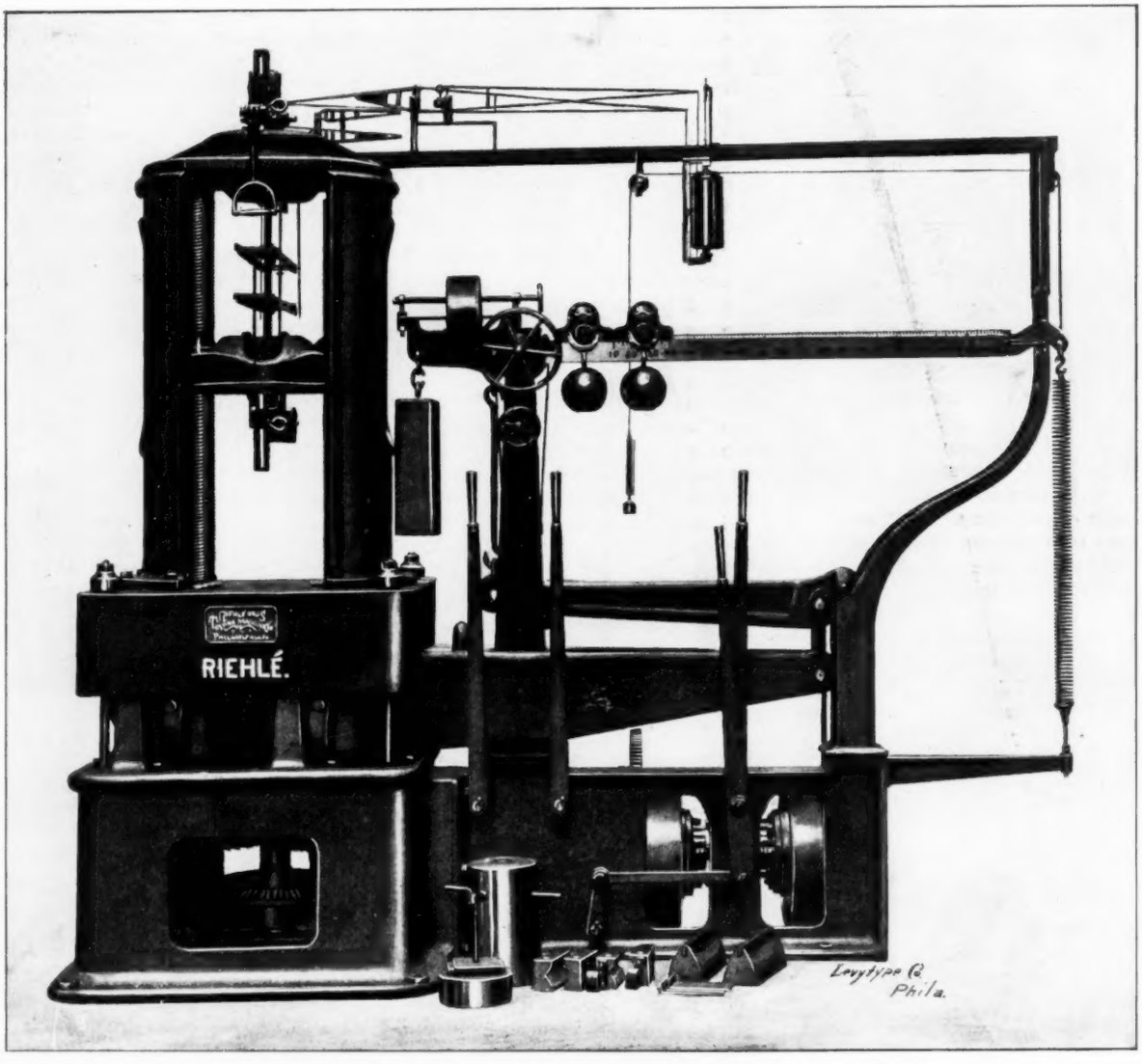
200,000-Pound Autographic Testing Machine.

We present herewith an illustration of a testing machine which the manufacturers state represents the very highest attainment of their establishment; that is to say, it is the best testing machine they know how to construct.

The top head is of cast steel, mounted on heavy columns which bear directly upon the scale table. The upper table rests upon a series of eight knife-edges of the main levers, which are of the best steel, hardened. There are two main or load levers of great strength, arranged in such a way as to be of nearly equal length, thus insuring stiffness and avoiding unnecessary vibration, which would obviously follow in the case of a long lever. They transmit the pressure to an intermediate lever, and thence to the weighing beam.

The lower head is operated by means of two powerful screws, revolving in brass nuts secured to the head. The bearings of these nuts are quite long for durability, representing about 13 inches in length in the two nuts, and are carefully fitted by gages and special tools. The thrust bearings of these two screws are taken up on a series of hardened steel balls, revolving between two grooved steel plates. This anti-friction arrangement has proved highly satisfactory.

On each screw is a large spur gear running with a smaller pinion, and in this pinion shaft is a large bevel gear whose pinion is on a shaft projecting into the box and transmitting the power from the gears outside of the box. Behind the main bracket of the machine are twelve gears and three clutches operated by levers in front of the machine, by means of which the speed of the machine is changed. In this same bracket are two friction pulleys, driven by open and crossed belts, respectively, and operated by the controlling lever, which starts, stops and reverses the machine. This lever, in combination with the three other clutch levers, furnishes eight pulling



200,000-POUND AUTOGRAPHIC TESTING MACHINE.

speeds to the machine and the same number of reversing speeds, though usually only the fastest speed is used in reversing.

There is a balanced lever that holds the lower grips and by which they are forced into position, and a series of liners with the wedges to suit variations in the sizes of specimens. There is also a balanced lever on the extreme top of the machine which carries the upper grips and by which they are placed in position. On account of the height of this machine, and in order that the beam and tools may be within handy reach of the operator, it is recommended that it be sunk into the floor 14¾ inches. Where this is not possible, a platform 14¾ inches high can be arranged to accomplish the same purpose.

This machine is entirely self-contained and there are no screws that pass below, requiring any opening in the floor. All the starting, reversing and stopping levers are handy and convenient to the operator, who has the machine under perfect control, and at the same time he can observe the movement of the beam, action of the automatic parts, and also the changes that may occur upon the specimens being tested.

The extreme height of machine is 8 feet 10 inches; extreme width 3 feet 7 inches; extreme length, 9 feet 9 inches. It will take in tensile test pieces 30 inches long down to 8 inches in length over all, with 25 per cent. elongation for 30-inch specimens; round specimens, 2½ inches diameter and less; square specimens, 3 inches and less; flat specimens, 4 x 1 inch and less; transverse specimens, 36 inches long by 12 inches wide or less; compression tools, 8 inches diameter with 2½-inch hardened steel centers; compression specimens, 24 inches high and less.

The speeds of the machine are as follows, at 225 revolutions of pulleys: Speed for setting head, 9 inches per minute; quick speeds for testing, 3¼ and 2¼ inches per minute; medium speeds, 1 and ¾ inch per minute; slow speeds, 1 inch in three minutes, 1 inch in four minutes and 1 inch in twelve minutes. The last named speed is used principally for crushing tests, and the fastest speed is not recommended for any test; it is only for setting the head, the extreme range of motion of which is 2 feet 6 inches. These speeds have been arranged as a result of the experience of experts in daily work, and are believed to cover all the requirements of practice.

This machine, as illustrated, is strictly automatic and autographic, and is shown with a Riehlé-Gray autographic attachment. This consists of the attached bars shown on the specimen and the system of levers on top of the machine, by which extension of the specimen is autographically recorded. This apparatus is fully described by its inventor in Vol. XIII of the "Proceedings of the American Society of Mechanical Engineers."

The machine is made by Riehlé Bros., Philadelphia, Pa.

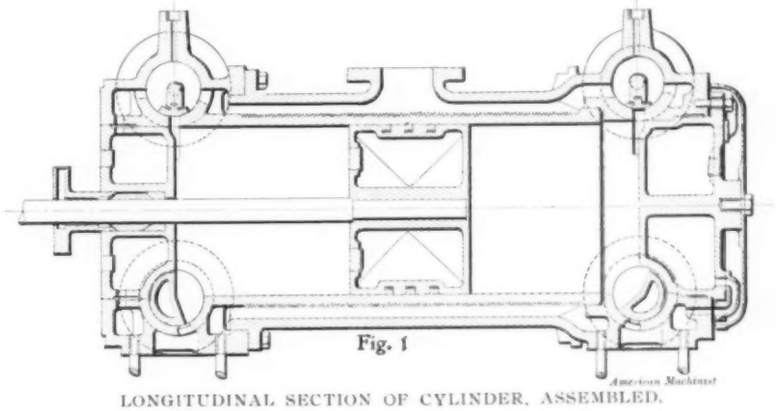
Some Features About the Belgium Engines of H. Bollinckx.

BY PROF. JOHN E. SWEET.

When the report was published in the "American Machinist" some months ago of a test of a single-cylinder condensing engine, about 17½ by 34½ cylinder, 80 revolutions, built by Mr. H. Bollinckx, of Brussels, giving a horse-power, on a little over 15½ pounds of water, which certainly exceeded in economy at least most single-cylinder engines, if not the best ever tested here, I asked the builder for some description of the engine. In response, one of his catalogs, with various documents and a personal letter, were received, which in substance set forth that the results were obtained from an engine wherein the subject had been thoroughly studied, mechanical arrangements used to carry the theory into practice, and by good workmanship. The engine was of the Corliss type, and the question was why, so long as our engine builders have certainly given the subject study, devised the very mechanism he uses, and are believed to do good work, we do not get equal results.

In commenting on these results and other engines, Mr. Bollinckx emphasizes the importance of *an active steam jacket* and does exactly what I believe the best authorities here condemn; that is, takes the steam from the jacket itself into the cylinder. If he gets the results and we do not, then the natural inference would be that we had better change our theory. One explanation is that the circulating jacket prevents accumulation of air, which is no doubt true. But the thought has come to me (and it is but a thought) whether it may not be possible, in a cylinder, in which the steam in the jacket is at rest, that the water of condensation forms on the surface and retards the transmission of heat, while in a cylinder where the steam is active in the jacket the water is swept away.

The ingenious English engineer, Druitt Halpin, has shown by actual test that a jacket corrugated on its outer surface is



LONGITUDINAL SECTION OF CYLINDER, ASSEMBLED.

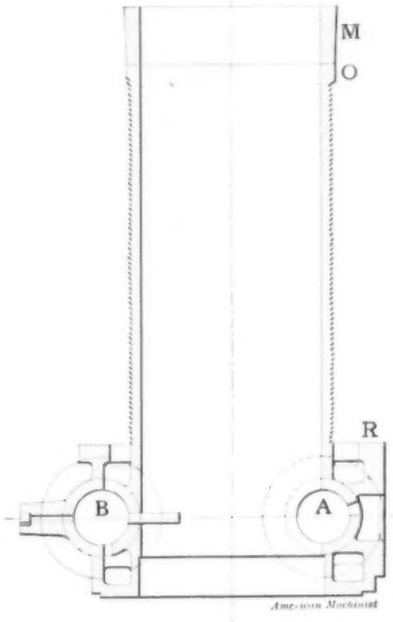


Fig. 2

INNER PORTION OF CYLINDER.

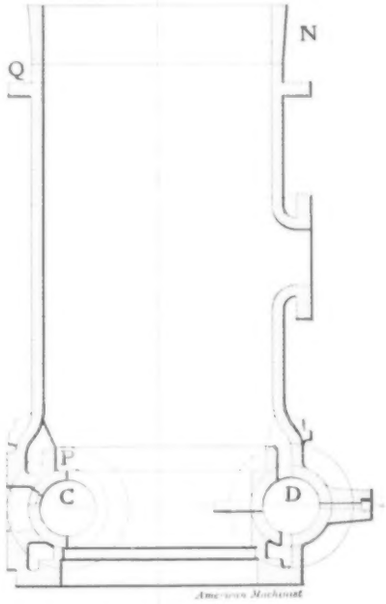


Fig. 3

OUTER PORTION OF CYLINDER.

much more efficient than a plain one, and Mr. Bollinckx uses a cylinder embodying this feature to a certain extent, as will be seen by the cut shown in Fig. 1, copied from his catalog. If this film of water action exists, except in the writer's imagination, it would in a measure explain why the ribs show such gain, as the water would be less likely to form. Figs. 2 and 3 show the two parts of the cylinder combined in Fig. 1, which seems an admirable form of construction.

There are many novel features in the Bollinckx engine and one in the catalog itself, which is, that he shows various modern forms of construction besides his own and sets forth the reasons for adopting those he does. As he has shown in the "American Machinist," he secures the fly-wheels to the shaft by a simple grip fit, and this where the fly-wheel is in two parts or

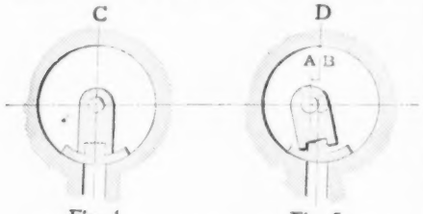


Fig. 4 Fig. 5

METHOD OF DRIVING THE VALVES.

the boss split is exactly the thing to do. If the wheel is a fit on the shaft, the binding bolts will amply secure it to do its legitimate work, and in case of any extra strains from any cause that would compel it to slip, then anything in the way of a key that would prevent its slipping is worse than useless.

It is doubtful if what constituted the real merits of Mr. Porter's plan [shown on page 432] has been fully emphasized. I say Mr. Porter's plan, because he it is who has made it known. To me it seems that the merit lies in this, that one-half the hole can be a real fit and not an imaginary one, and, too, the ample surface of the broad key he shows is an essential element.

In regard to securing fly-wheels, pulleys, etc., to shafts, a tolerably prevalent practice is to cast chambered holes, cutting away more or less, in many cases more of the bearing surface than is left. Is there anything in favor of this scheme except cheapness? I have seen many such wheels and pulleys removed, and many where it was very troublesome to hold them fast, and in all cases they had shown perceptible wear where the narrow bands bedded on the shaft.

At the Centennial Exhibition a prominent engine had a fly-wheel so chambered, and a key that fitted the whole length; where the key was driven the shaft bent as it ought. This could have been prevented by chambering the keyway the same as the pulley was chambered. But who thinks of or has the courage to do that? The chambered hole seems to be an admission that the builder either wants to save money or that he cannot bore a straight hole.

Mr. Bollinckx keys neither his wheels nor the cranks to the shaft, and with the exception of the original shafts in the steamship "City of Rome," and the universal practice in the construction of the crank-wheels of the straight line engine, few seem to have enough faith in a forced fit to trust it to do the driving.

In the design of the Corliss valves or method of driving them, the Belgian builder adopts the plan shown in Fig. 4. As shown in Fig. 5, wear in the rock-shaft journals does not tend to tip the valve off the seat, as is the case in the original Corliss plan. The area of the wearing surfaces in the bonnet bearings is increased as shown in Fig. 6, together with his method of lubrication. It is a question whether this method of relieving the spindle of wear is equal to the one adopted by Watts, Campbell & Co., or the later device schemed by Mr. Lane, of the Lane & Bodley Co.

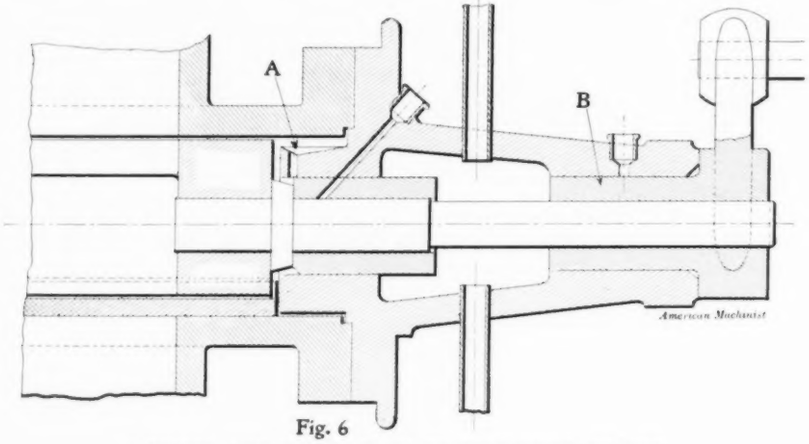


Fig. 6

BONNET AND VALVE STEM OF BOLLINCKX ENGINE.

Mr. Bollinckx employs the method of securing the piston rod used by Halsey. There is a lot to be said about the various methods mentioned, particularly if one will take pains to enumerate the bad features. There is no question but that in the parallel fit the end of the rod outside the key is stronger than in the case of the taper fit; but as to its being a stronger attachment, that is very questionable. In the case of the parallel fit the key has the whole load to sustain; in the case of the taper fit, likely aside from water in the cylinder, the rod would never come out of the crosshead if there was no key, the force tending to push it in always being greater than that to pull it out. Neither gives any means of adjustment, but if once made true they can be changed any number of times and be true; and, while the threaded rod gives adjustment with absolute truth, with either the split nut or check nut it requires a good deal more than ordinary machine work. A conical face on the nut entering a conical seat in the crosshead—a scheme first used by Wm. A. Sweet, so far as I know, and adopted by Mr. Armstrong on the Ames engine—is probably as cheap a way to get good results as any. Absolutely accurate threads render it possible to use the split nut. Almost any plan comes true enough if the crosshead and crosshead pin are short enough; but with increased length to secure additional wearing surface, increased accuracy becomes necessary.

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Pneumatic Dispatch Tubes.

It is announced that Philadelphia is to be the first city in the United States to be generally equipped and gridironed with a system of pneumatic dispatch tubes, for mail matter, telegrams and light packages. The pioneer American pneumatic tube for postal service was put in operation in Philadelphia a few years ago, and is a great practical success. It is about a half mile in length, extending from the Philadelphia Stock Exchange to the Post Office. The tube is 6½ inches diameter and is capable of carrying 48,000 letters per hour.

There are some private or semi-private installations of pneumatic dispatch tubes in use in this country by the telegraph offices and the newspapers, but generally we are far behind European cities in our appreciation and use of this means of transmission. The system has been in efficient operation for years in London, Paris, Berlin and Vienna. The systems employed in these different cities are quite different from each other in the details of construction and operation. For instance, London uses what is known as the radial system and Paris uses the circuit system. In London, both outgoing and returning tubes are laid radiating from a central station; while in Paris a single pipe from the central station makes a circuit of outlying stations and returns to the starting-point. The circuit system is used in Vienna, but in Berlin the circuit has been changed to the radiating system.

The tubes employed in all the European installations are of comparatively small diameter. London operates 42 stations

and 34 miles of tubes, carrying, it is estimated, 57,000 messages per day. Paris, with less than twenty stations, transmits nearly as many messages as London. Berlin has 38 stations and 28 miles of double tubing.

In the details, both of construction and operation, there is quite a diversity of practice. In London the individual carriers are operated upon by the propelling force; in Paris, pistons take long trains of carriers after them. In some cases a vacuum in front of the carriers is created, and in others compressed air operates behind them, or sometimes a combination of both methods is employed.

The sticking of carriers in the tubes is a serious occurrence, but means have been devised for meeting such a contingency. The fine system of sewers in Paris leaves all the tubes in that city easily accessible. When a pipe is obstructed a diaphragm is attached to the end of it, and a pistol shot is fired into the tube through an opening just below where the diaphragm is placed. The sound acting on the diaphragm, closes an electric circuit and makes a mark on a chronograph. The sound wave traveling through the tube, meets the obstruction and is reflected, and upon its return makes another mark on the chronograph. The interval of time indicated by the chronograph gives a ready means of determining the distance of the obstruction from the end.

We should be able now in this country to make a fine exhibit and a great success of pneumatic transmission, as we have the benefit of forty years of European experience.

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More Light on the Methods of the Cleveland Oil Swindlers.

Cleveland, O., June 30, 1896.

Messrs. Fay & Scott,
Dexter, Me.:

Gentlemen—Some time ago we shipped one-half barrel of Reserve Cylinder oil to Silver & Son, your station, which they refuse to accept, claiming that it arrived too late to be of use to them. Of course, you understand that we cannot very well afford to have oil returned; consequently, we are anxious to dispose of same. It is a very fine oil and guaranteed to give perfect satisfaction in every respect.

If you will favor us by taking same, we will make price 28 cents per gallon less freight and no charge for package.

Kindly let us hear from you, and oblige

Yours truly,
THE TIONA OIL CO.,
Per A. Mooney.

Instead of replying to this letter, Messrs. Fay & Scott sent it to us with the following indorsement:

American Machinist Publishing Co.,
New York:

Gentlemen—We do not know as this interests you, but it is a very taking letter, although we have no use for it. Messrs. Silver & Son run a saw mill about three miles from us.

Yours truly,
FAY & SCOTT.

We then wrote to Messrs S. E. Silver & Son, asking for particulars about this matter, and under date of July 13th have the following answer from them:

Silver's Mills, Me., July 13, 1896.

Mr. Fred J. Miller,
256 Broadway, New York:

Dear Sir—Your favor of 7th inst. is at hand. In reply will say that on April 29th we received a letter from the Tiona Oil Co., of Cleveland, O., stating that they had shipped, some time ago, one-half barrel of Reserve cylinder oil to a party in our vicinity, and finding him not responsible, had stopped delivery of goods. As they wished to dispose of the oil quickly, they would cut price to 28 cents per gallon, less freight, and no charge for packing, if we would take it. They also stated that it was a very fine oil, 650 fire test, and guaranteed in every respect.

We offered them 22 cents per gallon for the oil if it was what they represented it to be. They accepted our offer and sent bill with the letter, which stated that they had started tracer instructing the railway company to deliver goods to us without delay. Attached to bill was a discount slip allowing a discount of 2 per cent. if paid in ten days.

Later we received a letter dated May 25th, which read as follows: "We are building an extensive addition to our works and find that we have undertaken a larger contract than our funds would warrant; consequently, we desire to realize on our collections and beg to offer you a discount of 3 per cent. on our invoice of May 5th."

In the meantime we had seen a party who had purchased oil of the same company, in the same manner, the oil proving worthless. We judged from this and the numerous discounts which they offered that they were a fraudulent company, and wrote them to cancel the order. A few days later the oil arrived, shipped direct from Cleveland, O.

Hoping that this may aid you, we are,

Yours truly,
S. C. SILVER & SON,
A. E. S.

This, it will be seen, throws some additional light on the methods of these oily swindlers, and the effort to secure payment from Messrs S. C. Silver & Son before arrival of the oil is obviously owing to the expectation that it would be refused on arrival if not previously paid for. The story about the tracer and the discounts offered is all for this purpose of securing payment "sight unseen," and the oil was finally shipped direct from Cleveland when hope of getting such advance payment had vanished.

Value of Boiler Inspection Laws.

Straw-burning engines driving thrashers are quite numerous in the wheat-growing States. The first engine in Minnesota dates from 1879, and in the few years following, serious or fatal accidents were frequent. The number of such engines now in the State is nearly 2,500. Boiler inspection laws are now in force, and last year but two accidents were reported, both the result of ignorance and carelessness. Four years ago North Dakota repealed its boiler inspection law, and since that time accidents have increased alarmingly; machines previously condemned have been brought out again, often to finish up their careers with disastrous explosions.

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A Chronometer Race.

The British Astronomer Royal reports upon the annual competitive trial of chronometers for the Navy. Eighty-three chronometers were sent in and were tried for twenty-nine weeks, the temperatures ranging from 42 to 150 degrees. The performance of the chronometers generally is said to have been remarkably good, sustaining the marked improvement of the previous year's trial. Fifty-three were bought for the service.

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General Flagler, the Chief of Ordnance Department, U. S. A., has at last succeeded in his ambition to start the construction of a 16-inch rifled gun, and has secured an appropriation for that purpose. He has invited bids for the forgings, and the gun will be constructed at Watervliet as soon as practicable. This gun will enable the great lathe which we illustrated in our issue of April 9th to be tested to its full capacity. The construction of guns of this size has been opposed by certain influences, perhaps emanating from the Navy; since it has been found that guns of 16-inch calibre cannot well be properly mounted and handled at sea, being, of course, subject to limitations and restrictions which do not exist on land and for coast defence armament, and the construction and performance of the new gun will be watched with considerable interest by the ordnance men.

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Some interesting experiments have been made as to the air pressure in bicycle tires. The bicycle tried was a "Victor," with "Palmer" single-tube tires, and a rider weighing 175 pounds. Without the rider, the pressure on the front tire was 9 pounds, and on the rear tire 26 pounds. When the rider mounted, the increase in pressure in the front wheel was not perceptible, and in the rear wheel it was less than half a pound.

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July 25th the Penberthy Injector Co. celebrated the completion of their 100,000 injector by giving their employés a holiday and excursion.

ELECTRICAL MACHINERY.

The Advantages of the Multipolar Type of Electric Machinery.

BY WM. BAXTER, JR.

(Concluded.)

As has already been stated, the number of turns of wire that must be wound upon the field to obtain a given density will be proportional to the magnetic resistance or "reluctance," as it is called, of the magnetic circuit. This resistance is composed of two parts—that of the air space between the armature and the poles of the field, and that of the iron in the field and armature through which the magnetism passes. The resistance of the air space will be the same in each case, but that of the iron will be proportional to the length of the dotted lines which indicate the path of the magnetic circuit. As will be noticed, these lines are much longer in Fig. 1 than in Fig. 2, and longer in the latter than in Fig. 3. The difference will be found to be very nearly in the proportion of 1, 2, 4. The number of turns of wire that must be wound upon the magnets in each case, to obtain the same density, will be in the ratio of 1, 2, 4 for the resistance of the iron, plus the same amount in each case to overcome the resistance of the air space, or "air gap," as it is called by electrical engineers. If the resistance of air and iron were equal, or anywhere near equal, the number of turns of wire on the magnets of the thin machines would be nearly in the proportion of 1, 2, 4; but the resistance of the air for the same length and area is several hundred times greater than that of iron. Therefore, in Fig. 1 about one-half the wire wound on the field would be required to overcome the resistance of the short air gap. From this we can see that the number of turns of wire wound on the magnets of each machine would be about as follows: For No. 1 machine, 1 part for air gap and 1 part for iron circuit, total 2; for No. 2 machine, 1 part for air gap and ½ part for iron, total 1½; for No. 3 machine, 1 part for air gap and ¼ part for iron, total 1¼; or in the proportion of 1 for No. 1, ¾ for No. 2, and ⅝ for No. 3. The cross-section of the wire in the spools *D* in the three machines is drawn in about this proportion, as will be seen at D^1, Fig. 1, where the sections of the three coils are superimposed to facilitate comparison.

The following shows that the three machines are of the same capacity; the difference in the size of the diagrams, which are all made to the same scale, shows the difference in the size and weight of the machines. This comparison does not show the total difference in favor of the multipolar machine; it simply shows the gain where the number of turns of wire on the armature remains the same. As a matter of fact, as the number of poles is increased, the wire on the armature can be increased, and this will make the gain due to the greater number of poles still more. The number of turns of wire that can be placed upon an armature is limited by what is known as "armature reaction," which, in plain English, is the effect that the current in the armature makes to twist around the polarity of the field. The wire *D* D^1

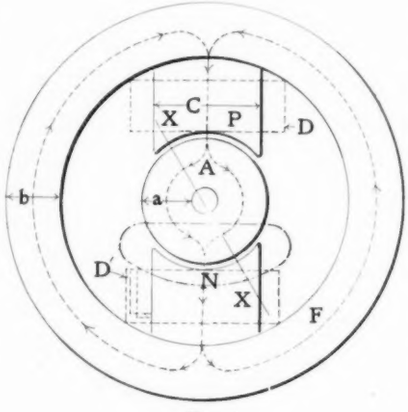

Fig. 1

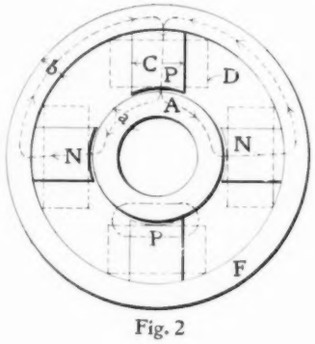

Fig. 2

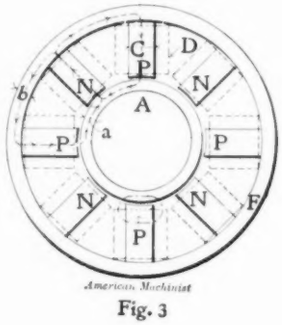

Fig. 3

on the poles *P N* in Fig. 1 develops a magnetic force in the direction shown by the dotted lines. The wire on the armature tends to develop a magnetic force at right angles to this, as shown for one pole by the dot and dash lines. As these two forces act in different directions, the result is that the direction of magnetism through the field is diverted from its proper position, and assumes a direction at an angle to it, as shown by the line *X X*. The angle that this line will make with the line through the center of the poles will depend upon the reacting force of the armature, and this will be proportioned to the number of turns of wire on it. If this angle is very great the brushes will spark badly; therefore, to avoid sparking, the wire on the armature cannot exceed a certain amount. Now, in Fig. 1 all the wire on the armature acts against the field wire, because the whole of it exerts an effort to establish a single pair of magnetic circuits, one of which is shown by the dot and dash line at right angles to the field magnetism. In Fig. 2 only one-half of the armature wire acts against the field, because two pairs of magnetic circuits are developed, one-half of one pair being shown by the dot and dash lines. In Fig. 3, one-quarter of the armature wire acts against the field, because four pairs of magnetic circuits are developed. For these reasons, in Fig. 2 more wire can be placed upon the armature than in Fig. 1, and in Fig. 3 more than in Fig. 2. Hence, the total possible gain by the multipolar construction is greater than the difference in the size of the diagrams would indicate by an amount equal to the extra amount of wire that can be placed upon the armature without increasing the armature reaction.

It may not be made quite clear in the above how in Fig. 1 all the armature wire acts against the field, while in Fig. 2 only one-half acts, and in Fig. 3 only one-quarter; but if the dot and dash lines in the three diagrams are compared, it will be found that in the first the lower half of the armature is covered by the curve, but in the second and third, only one-quarter and one-eighth, respectively, are covered. To put it plainer, in the first figure half of the armature wire acts against each pole; in the second, one-quarter of the wire acts against each pole, and in the third only one-eighth. In this article the advantage of the multipolar construction has been explained by showing the reduction in size of machines of equal capacity by an increase in the number of poles, because in this way the difference can be presented clearly to the eye, as a comparison of the size of the three diagrams, which are drawn to the same scale, at once shows the gain. The subject could have been explained just as well by showing that with machines of the same size the capacity would increase with the number of poles. Such a demonstration, however, could only be made by the aid of calculations, which, although simple, would not be so clear as the difference in size of diagrams.

The gain effected by increasing the number of poles can be utilized in several ways. If it is desired to maintain the speed the same as with the two-pole machine, the size can be reduced. If it is desired to use a part of the gain to increase the efficiency, this can be done by making the reduction

in size somewhat less than shown in the diagrams, in which case some of the wire could be dispensed with. This would reduce the resistance of the machine, and thus increase its efficiency. If it were desired to utilize the gain wholly in obtaining higher efficiency, the result could be accomplished by leaving the size of machine unchanged. In this case a very large proportion of the wire could be removed, and the reduction in the resistance caused thereby would very materially increase the efficiency.

In practice, the advantage of the multipolar construction is generally made use of to reduce the speed. At the present time, electric generators direct-connected with steam engines are used very extensively, and for this purpose the multipolar type is always employed. The highest velocity at which steam engines can be run successfully is very slow compared to the speed at which two-pole machines must be driven in order to keep their size, as compared with their capacity, within reasonable limits; but by increasing the number of poles to six, eight or more, the velocity can be reduced to that of the engine without increasing the dimensions of the generator to an unreasonable extent.

For large size machines there is no objection that can be made against the multipolar type, unless it be that, as at present constructed, they have brushes all around the commutator, the number being equal to the number of poles. This increase in number of brushes is undoubtedly an objection, because it increases the difficulty of adjusting them to the non-sparking points, and furthermore, as those on the under side of the commutator are not very accessible, they are much more liable to be neglected. It is not necessary, however, to use so many brushes; a machine with any number of poles can be made with two brushes, by proper connections between the armature wires and the commutator, and in the opinion of the writer the multiplicity of brushes will be discarded before many years go by.

For small machines the multipolar type is not so suitable, owing to the fact that the commutator has to be made very much larger, and even then, in many cases, the connections with the armature wires are so numerous that sufficient space to properly secure them cannot be obtained. Nevertheless, when the electromotive force of the machine is so low that the number of commutator sections can be very considerably reduced, it can be used advantageously even on very small machines.

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The new factory of Tiffany & Co., at Forest Hills, N. J., will be operated entirely by electric power. Two 125 horsepower General Electric dynamos will furnish the current which will be utilized by more than twenty motors distributed about the works.

Electrical Tests of Power Required by Wood-Working Machinery at the Navy Yard, Washington, D. C.

REPORTED BY PROF. O. G. DODGE, U. S. N.

In the case of the following tests, the mechanical horse-power delivered by the motor was determined by tests made under the same conditions as the previous power tests. This was necessary, as in many cases long leads were run to the motor and the drop was large. In other cases it was necessary to use a rheostat in series with the armature to obtain the required speed. Under these conditions the efficiency of the motor was a very variable factor, and a separate test was made in each case to determine the output of the motor. The column of mechanical output is therefore the proper one to use in determining the motor required, and the electrical horse-power to be delivered by the generator.

The work done is the heaviest that will be required of these particular machines:

Circular Rip Saw.

Saw 28 inches diameter; speed, 1,200 revolutions per minute or 8,800 lineal feet per minute. Arbor pulley 5¼ inches diameter by 8½-inch face; hand feed; motor belted to saw shaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Del'd.
Motor and saw, idle	14	180	3.4	2.1
Ripping seasoned heart oak, 7⅝ inches thick; feed, 10 feet per minute	90	160	19.3	18.8

Circular Rip Saw.

Saw 24 inches diameter; speed, 1,500 revolutions per minute or 9,429 lineal feet per minute; hand feed; motor belted direct to 7-inch pulley on saw shaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Output.
Motor driving saw, idle	12	200	3.2	.8
Ripping seasoned heart oak, 6 inches thick, 10 feet per minute	50	190	12.8	11.
Ripping seasoned white pine, 6⅛ inches thick, 15 feet per minute	35	200	9.4	7.3
Ripping seasoned yellow pine, two inches thick, 45 feet per minute	40	200	10.7	8.9

Circular Rip Saw.

Saw 14 inches diameter; speed, 2,200 revolutions per minute or 8,067 lineal feet per minute; Arbor pulley, 3 inches diameter, 5 inch face; hand feed; motor belted to saw shaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Del'd.
Motor, idle	..	...	.96	....
Motor and saw, idle	20	103	2.7	1.5
Ripping seasoned heart oak, 3⅛ inches thick, 12 feet per minute	70	67	6.3	5.3

Circular Rip Saw.

Saw 12 inches diameter; speed, 2,200 revolutions per minute or 6,914 lineal feet per minute; hand feed; belt pulley 3½ inches diameter and 3-inch face; motor belted direct to 3½-inch pulley on saw shaft; saw set to wabble for cutting grooves:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Output.
Motor, idle	..	...	.96	....
Driving saw, idle	16	102	2.2	1.
Cutting groove in seasoned walnut, ⅜ x ⅝ inches, 12 feet per minute	30	90	3.6	2.6

Band Saw.

Saw pulleys 72 inches diameter; speed, 160 revolutions per minute or 3,017 lineal feet per minute; belt pulley 30 inches diameter, 8-inch face, power feed; motor belted to saw shaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Del'd.
Motor and saw, idle	45	200	12.1	10.4
Ripping seasoned ash, 10¾ inches thick, feed 6 feet per minute	65	185	16.1	14.8
Ripping seasoned white pine, 16½ inches thick, feed 10 feet per minute	65	185	16.1	14.8
Ripping yellow pine, 12 inches thick, 20 feet per minute	80	175	18.8	17.6

Band Saw.

Saw pulleys 42 inches diameter; speed, 350 revolutions per minute or 3,850 lineal feet per minute; belt pulley 16 inches diameter, 5-inch face; hand feed; motor belted to saw shaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Del'd.
Motor, idle	..	...	.96	....
Motor and saw, idle	30	72	2.9	1.9
Ripping seasoned oak, 12 inches thick, feed 3 feet per minute				
Cross-cutting seasoned oak, 8 inches thick, feed 5 feet per minute	65	65	5.7	3.6
Ripping live oak, 10 inches thick, feed 3.2 feet per minute				

Band Saw.

Saw pulleys, 28 inches diameter; speed, 480 revolutions per minute or 3,520 lineal feet per minute; belt pulley 12 inches diameter, 3½-inch face; hand feed; motor belted to saw shaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Del'd.
Motor, idle	..	...	.96	...
Motor and saw, idle	16	80	1.7	.90
Ripping seasoned oak, 3 inches thick, feed 2½ feet per minute				
Ripping seasoned pine, 3 inches thick, feed 4 feet per minute	25	70	2.3	1.3
Cross-cut seasoned oak, 3¼ inches thick, feed 4 feet per minute				

Daniels' Planer.

Machine bed 2 feet 5 inches by 21 feet 6 inches; belt pulley 13 inches diameter by 5¼-inch face; speed, 350 revolutions per minute; speed of cutting edges of tool 10,400 feet per minute; power feed 12 feet per minute; motor belted to countershaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Output.
Motor, idle	..	...	.96	....
Driving machine, idle	47	62	3.9	2.8
Planing seasoned oak, cut ⅛ inch deep by 20 inches wide, 12 feet per minute	77	60	6.2	5.1

Hand Cylinder Planer or Jointer.

Size of machine 24 inches; belt pulley 4 inches diameter, 5-inch face; speed 3,200 revolutions per minute; speed of cutting edge of tool 4,000 feet per minute; hand feed; motor belted to shaft of tool:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Output.
Motor, idle	...	...	.96	...
Driving machine, idle	18	100	2.40	1.4
Planing white pine, cut $\frac{1}{16}$ inch deep by 18 inches wide, 25 feet per minute	45	80	4.80	3.8

CYLINDER PLANER.

Size of machine 24 inches; belt pulley 5 inches diameter, 5-inch face; 2,250 revolutions per minute; speed of cutting edges of tool 3,105 feet per minute; power feed; motor belted to shaft of tool:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Output.
Motor, idle	...	...	.96	...
Driving machine, idle	18	100	2.40	1.4
Planing pine, cut $\frac{1}{8}$ inch deep, 18 inches wide, 11 feet per minute	29	92	3.6	2.5
Planing oak, cut $\frac{1}{16}$ inch deep, 6½ inches wide, 11 feet per minute				

BORING MACHINE.

Speed of bit 375 revolutions per minute; hand feed; motor belted to bit shaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Output.
Motor, idle	...	...	.96	....
Driving machine, idle	14	88	1.7	.5
Boring 4 inch hole in seasoned oak, 9⅜ feet per minute	24	70	2.3	1.2

BORING MACHINE.

Belt pulley 8 inches diameter, 3-inch face; speed 750 revolutions per minute; hand feed; motor belted to machine shaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Output.
Motor, idle	...	...	.96	....
Driving machine, idle	20	70	1.9	.8
Boring 1-inch hole in oak, feed 3¼ inches in 5 seconds	30	55	2.2	1.1
Boring 1⅝-inch hole in oak, feed 1 inch in 7 seconds				

PATTERN MAKERS' LATHE.

Speed 888 revolutions per minute; motor belted direct to lathe:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Output.
Motor, idle	...	...	.96	....
Driving lathe, idle	14	105	2.	.9
Turning seasoned poplar, 12 inches diameter, ½ inch cut	25	95	3.2	2.

CARVER AND MOLDER.

Speed of tool 5,236 revolutions per minute; motor belted direct to tool shaft:

Readings.	A.	V.	Elect. H. P. Abs'd.	Mech. H. P. Output.
Motor, idle	...	...	.96	....
Driving tool, idle	25	83	2.8	1.7
Cutting groove, circular sector, 2 inches wide, ¾ inch deep, 3½ feet per minute, in white pine	30	75	3.9	2.9

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The lift bridge over the Erie Canal at Genesee street, Utica, was originally planned to be operated by electric motors working through screws. This plan absorbed so much power that compressed-air cylinders were substituted for the screws—the compressor being driven by an electric motor. One of our electrical contemporaries says: "This is an instance of the great flexibility of electricity." Yes; but where does the compressed air come in?

Letters from Practical Men.

Speed of Twist Drills.

Editor American Machinist:

An old saying is "Circumstances alter cases," and this fits pretty well the question on speed of twist drills.

Under some circumstances the speed of the cutting edge of a twist drill when cutting wrought iron will not stand to run more than 20 feet per minute; that is to say, a twist drill ¼ inch diameter may not be allowed to run more than about 300 revolutions per minute, but the same drill may, under other conditions in the same material (I do not mean to say always in the same piece of work), be run twice as fast and still keep its cutting edge well.

The speed of twist drills cannot be satisfactorily determined by any hard-and-fast rule, based upon the diameter of the drill, because, in order that the work shall be done as economically as possible, the question of the speed of the drill resolves itself into how fast we can dispose of the heat generated by drilling.

Anyone familiar with the hollow drill used so extensively in drilling gun-barrels, and which is also used with advantage when drilling any other long holes of similar nature, will know the truth of this statement. Those drills are not twist drills, but they have a straight groove cut on one side; in this groove the chips are coming out, and another groove is cut on the back side, into which a strip of metal is fitted, making a covered channel the whole length of the drill from the shank to the cutting edge. By a suitable force pump and through suitable connections, oil is forced through this covered channel right up on the cutting edge of the drill; this oil keeps the drill cool, and it also washes out the chips.

A drill of this kind may have a cutting speed at the outer corner of the cutting edge of 180 feet per minute, or the work may revolve about 900 revolutions per minute when drilling a ¾ hole. It may sometimes be run even faster than that. Of course, very fine feed is used—less than 0.001 inch per revolution.

Whenever the nature of the work permits this way of drilling, it is the most perfect way that can be imagined; it is delightful to see how the chips roll out of the hole, and the drill will work at least ten hours without resharpening. This process may be called "practical perfection in drilling."

But let us go to the other extreme and see how drilling may be done. Suppose, for instance, we are to make an extra long, special ⅞-inch nut, so that a pressed blank cannot be used. A square piece of soft steel of suitable size is procured; a good sharp ¾-inch twist drill is put into the drill press. The piece of steel to be drilled is held in a monkey-wrench. In order to be sure that the drill when coming through the nut shall not be fed into and ruin the table of the drill press, it is necessary to either swing the table so that one of the slots or holes comes directly under the center of the drill, or we may find a suitable piece of iron with a hole in it to lay on the drill table. The drill table is heavy and bothersome to swing, and a piece of iron of suitable shape is not at hand; but a very nice piece of hardwood, square and planed, that some of the other fellows had been using in strapping a casting on the face plate of a lathe, is lying very convenient. This is taken and placed under the nut on the drill table, an oil can procured, and the drill press is started; and the ¾-inch drill makes 100 revolutions per minute, which will be a cutting speed of about 20 feet. To all appearances everything is satisfactory, but soon the drill begins to squeal and the oil to smoke. Were it not that we know this piece of steel was so soft when trimming it off in the vise with a file, the first thought would be to take it to the blacksmith shop and have it annealed; but now the only thing which suggests itself for an improvement is to run the drill at the slowest speed, and by grinding the drill and pouring on plenty of oil, and letting it squeal and smoke, the hole gets through, but the drill is round on the corner and blue for about an eighth of an inch.

All the trouble is due to the wooden block which was laid under the piece, because it is a well-known fact that wood is a very poor conductor of heat. Never use a block of wood for this purpose. Such things of course are never done in modern machine shops; but anyone who has a chance to go into different shops will not travel very far before he can see such a thing and a good many others that he does not expect to see. The same ¾-inch drill, if working on a bar of the same kind of soft steel lying on an iron block, will not heat or cause any trouble at all when running at a speed of 100 revolutions per minute.

When the pieces to be drilled are large in proportion to the size of the drill, the speed of the drill may be proportionally increased, because a large body of metal carries the heat away from the drill more quickly. If the holes are not deep, the drill may also be run comparatively faster, because, if the drilling lasts only a short time, there is not so much chance for the drill to get hot, neither is there so much difficulty in getting the lubricant onto the cutting edge.

When drilling pieces where the whole stock is taken out and only a thin shell is left—as, for instance, in drilling drop-forged bicycle connections—the drilling may be accelerated to a considerable extent by constructing the jigs and holders in such a way that there is plenty of metal surrounding the piece to be drilled, because the metal will help to disperse the heat and keep the drill cold.

In calculating the speed of twist drills, a table calculated according to the diam-

eter of the drill, on the base of 20 feet of cutting speed per minute for wrought iron, is useful as a guide, but it must be used with judgment, as frequently, when drilling small and short holes in comparatively large pieces, this speed may be increased even 100 per cent. But drilling very deep holes in small pieces as compared to the diameter of the drill, the speed may have to be reduced.

Frequently we hear the stereotyped advice that "only the very best lard oil should be used in drilling." Very well, "the best is good enough;" but for twist drills in some kinds of drilling, the "Peerless" drilling compound will do just as much and even more work, and it costs only a trifle compared to lard oil. This is not said in order to advertise the drilling compound; but when we know a good thing, it does no hurt to speak of it, even if this good thing happens to belong to somebody else.

PEDER LOBBEN.

Fitchburg, Mass.

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The Front Wheels of Motor Vehicles.

Editor American Machinist:

In your issue of July 23d, W. H. Booth, in his article on "Motor Vehicles in England," says: "In regard to construction, it is clear that there is a good deal of difference between a horse-drawn vehicle and one self-propelled. The leading wheels must be made stronger, because they are now pushed into holes rather than lifted out of them, and are thus much more strained."

I think that was caused by a slip of Mr. Booth's pen. I am sure, if he will stop to think, he will see that the statement about there being a tendency to push the front wheels into rather than pull them out of holes, is entirely wrong. In fact, the tendency is exactly opposite to that stated, and if enough power be applied, the front wheels may be lifted clear of the ground. Wheelmen are able to lift the front wheels of their machines clear of small obstructions by a sudden application of considerable power through the pedals. Of course, this only applies to vehicles which are driven from the rear wheels, but were the leading wheels the drivers the effect would be exactly as Mr. Booth states.

Continuing, he says: "The rear wheels have ceased to be simply supports to a vehicle; the power to propel the vehicle now passes through them." All of which is very true, and in addition to that the rear wheels must carry all the weight that is taken off the front wheels by reason of the force applied to drive the vehicle.

I think it will hardly be necessary for me to go into the details of the principles involved, as your readers, I presume, have a pretty good idea of it from the traction engine controversy that went on in your columns some time ago. The traction engine is nothing more than a motor vehicle which is designed to propel itself, as well as haul other vehicles, such as threshing machines and wagons. The same principles apply to both. I have seen traction engines sit up on the end of their boilers in trying to pull too heavy loads.

THEODORE H. MILLER.

Brooklyn, N. Y.

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Asbestos Pipe Coverings.

Editor American Machinist:

In your issue of July 23d I notice an article on Asbestos, in which its supposed great value as a non-conductor for steam pipe coverings is referred to. The persistent life of this ancient superstition, in the face of facts which should have killed it years ago, is really curious. The fact is, that of the substances used for steam pipe coverings, asbestos is among the poorest of the lot, so far as its insulating properties are concerned.

If you will look in the Transactions of the A. S. M. E. for 1881, you will find a paper by C. E. Emery, giving the results of some experiments made by him in order to determine the best insulator to be used with the pipe system of the New York Steam Co. In these experiments, hair felt stood at the top of the list as an insulator, and its value on a comparative scale was taken as one. The scale then ran in part as follows:

Hair felt	1.
Mineral wool	.832
Sawdust	.68
Charcoal	.632
Loam	.55
Slacked lime	.48
Asbestos	.363
Coal ashes	.345
Coke	.277

The above table tells the story, and shows that the value of asbestos is but a little over one-third that of hair felt, and but a little more than prosaic coal ashes. If coal ashes could be made to cost forty dollars a ton, which is about the cost of the grade of crude asbestos used for this purpose, perhaps we should see a great industry built up in supplying them for steam-pipe coverings.

Additional and much more extended experiments were made by Prof. J. M. Ordway for the Boston Manufacturers' Mutual Fire Insurance Co., and were reported in the Transactions of the A. S. M. E. for 1884 and 1885. The following table is abstracted from Professor Ordway's paper in the volume for 1884, and gives the kilogram centigrade heat units transmitted per hour through a thickness of twenty-five millimeters. It will be observed that Mr. Emery gave the value of the different substances as insulators, while Professor Ordway compares them as conductors. Consequently, the substances having the higher values in the first table have the lower ones in the second:

Fine table salt	36.0
Fine washed sand	30.7
Fibrous asbestos	24.2
Anthracite coal	17.6
Plaster of paris	15.3
Calcined magnesia	6.2
Cotton, compressed	4.5
Wool, compressed	4.0

The third table is abstracted from those given by Professor Ordway in the volume for 1885. It is arranged like the last in order of conductivity, the heat units being, however, the pound Fahrenheit per square foot per hour:

Fine table salt	731.
Fine sand	623.
Fibrous asbestos	489.
Anthracite coal, ground	357.
Extremely fine sand	317.5
Plaster of paris	309.4
Fossil meal	157.
Hair felt	102.3

Of course, asbestos has other valuable properties for this purpose, especially its non-combustibility, and the proper method of using it would seem to be to make use of this property by having an inner layer of asbestos to protect outer layers of hair felt from charring, due to immediate contact with the pipes.

It should be further noted that while the difference between different coverings seems large, it is really small when compared with a naked pipe. Thus, with about the poorest commercial covering experimented on by Professor Ordway, the loss of heat was but 11 per cent. of that from a naked pipe. In other words, any fair covering will save about nine-tenths of the loss, and the remaining one-tenth leaves a pretty small margin for improvement.

H. L. STONE.

▲ ▲ ▲

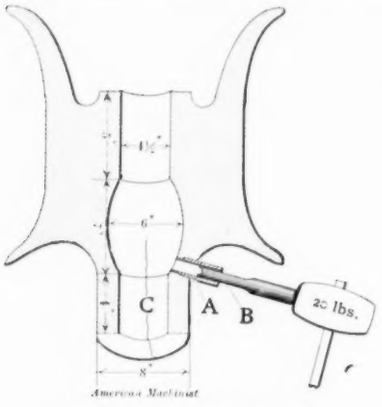
Starting a Stuck Hub.

Editor American Machinist:

Not long since the writer bought a second-hand steam winch taken from a wrecked English steamer, and in adapting it for the use it was proposed to put it to, it became necessary to remove two capstan heads from the ends of the drum shaft. One of these came off after about the usual amount of persuasion, but the other resisted all of the appliances I was able to get into action upon it, aggregating over a hundred thousand pounds. The shape of the hub was as shown, the cored-out portion holding about a quart of liquid. A hole was drilled as shown, and the cavity filled with benzine and allowed to stand overnight. As it still refused to start, I tapped the hole and screwed in a piece of heavy pipe, the bore of which was reamed to $\frac{5}{8}$ inch. Into this a steel plunger was tightly fitted, the outer end being larger and about a foot long. The cavity was still full, and the pipe nearly filled with thick grease, and the plunger struck a powerful blow with a 20-pound sledge-hammer, the idea being that the displacement of the plunger would force the benzine through the rust in the joint, and thereby assist in loosening the hub. The method proved effec-

tive in starting the hub, but not in the way expected, for the internal pressure of the benzine caused by the blow of the sledge had cracked the hub as shown by the line *C*, *A* being the reamed pipe and *B* the plunger. It is needless to say that the capstan was then easily removed. But I wonder what the pressure was?

This winch was very solidly built, and



STARTING A STUCK HUB.

without any possible means of adjustment in any of its moving parts, the rods and valve stems being solid forgings. The latter were ring-ended in the steam chests and nicely fitted over circular projections on the back of the valves. I suppose that as these winches are intended for rough usage on the decks of vessels, the surety of their not getting out of adjustment is of more importance than the possibility of getting them right again should they become disarranged.

PETER H. BULLOCK.

▲ ▲ ▲

The "Peculiar Planing" Job—Measurements in a Scottish Machine Shop.

Editor American Machinist:

I do not agree with all Mr. Randol says about "Peculiar Planing." The only thing I was ever responsible for in that line was clamping a slate taper attachment to the housings, which probably has occurred to many. I don't criticise the two jobs, for I quite appreciate their novelty, but he don't say if the radius of the job is supposed to be the same as the link connection radius.

I can quite understand why a timid and fussy designer might apply a micrometer adjustment on such a job. I don't mean planing approximate curves for a boiler, but to plane a radius as much of a standard article as a bored hole fitting a standard plug. Perhaps the Baldwin Works have some system of knowing the exact radius the planer man has on the point of his tools, but doubt if they would care to see a thread tool on the job, and am of the opinion that if it kept a point it would be the only kind of tool that would transfer the connection radius to the job.

But dimensions in thousandths on a drawing are not always realized on the job, which is quite the case here. A "shade" this or that is our style, and anything approaching the micrometer or any of its relatives is condemned on general principles before it is understood enough to take a measurement, and from the "mawsters" to the men the same old round-cornered scale grandfather carried in the leg of his trousers is the prescribed method for all time to come. Ten-pound hammer, one-pound centerpunch, one-ounce job on bench one inch thick is about the prescription—But they may have had a turn at the needle-straightening job.

I doubt if the split versus solid lathe box question would long remain a mystery, especially so long as the fiend lives that "jimmies" them apart and has about as much respect for the split box as the "jimmy" man has when he gets at his box.

YANK.

Edinburgh, Scotland.

▲ ▲ ▲

Productive and Non-Productive Labor.

Editor American Machinist:

I was interested in your recent editorial on "Productive and Non-Productive Labor in the Shop." As you suggest, where this classification is employed the term " non-productive" is more or less a libel upon a large class of necessary employés, and both terms are misleading to the management employing them. The terms seem to be entirely inapplicable to other than manufacturing establishments. In mercantile establishments they evidently could not apply, unless the productive ones might be said to be the drummers on the road who rake in the orders. Even in the shops it is not so easy to carry out the idea of productive and non-productive and to draw the line between them. I could point out one large establishment where a blacksmith's helper would be classified as non-productive, while generally, I suppose, he would be put on the other side of the list.

A lathe may have two qualities more prominent than any others, and these may be strength and precision. The strength, or the ability to make many large chips in little time, would be indisputably a productive quality, while the quality of precision, or the ability to turn out work true and accurate, would by many be classed as a non-productive quality; yet we mechanics all know that the latter quality is the most costly to develop and the most valuable for a lathe to possess. If, in this connection, I was called on to characterize the most striking phase of modern progress, I would say that it consists largely in developing the productiveness of the "non-productive." In our systems for computing the cost of production we still go on separating the productive and the non-productive labor, and trying to reduce the ratio of the latter, when, as a matter of fact, after long years of effort we have accomplished no appreciable reduction. The proportion of non-productive labor in the shops is still, as some would view it, enormously high. With our traveling cranes and our air hoists we have perhaps got rid of a few helpers, but we have very generally increased our office and supervising and directing force. Our output per capita has been vastly increased, and if it is looked into it will be found to be on account of the increased productive efficiency of the "non-productive" part of the organization. Brains are "non-productive;" but brains still must predominate wherever high production rules.

MORRIS FULTON.

Philadelphia.

▲ ▲ ▲

Expansion of Shafting.

Editor American Machinist:

A shaft 70 feet long which connected two others by level gearing was placed in position one winter while the mercury registered from below zero to 10 degrees or 15 degrees above. Later it dropped to 10 degrees below. The boxes were fastened to timbers which in turn were bolted to granite foundations. End play was prevented by placing the end boxes against the gears. The shaft runs under two buildings, and in winter may have a temperature of zero or under, and in summer 80 degrees or 90 degrees.

The following summer complaint was made that the shaft was moving endwise. No reason could be found for the trouble until someone suggested expansion, owing to the warm weather, at the time about 70 degrees.

Calling the expansion of wrought iron .00000648 of its length per degree Fahr., and difference of temperatures 70 degrees, we have as the total stretch of a 70-foot shaft: $70 \times 12 \times 70 \times .00000648 = .381$ inch, or, roughly, about $\frac{3}{8}$ inch.

The result was rather surprising, having never been raised before. To make matters more interesting, the temperature is liable to vary between — 30° and 90°, or 120° total. Have any of your readers been troubled by a similar cause?

WM. SANGSTER.

▲ ▲ ▲

Device for Centering Long Shafting.

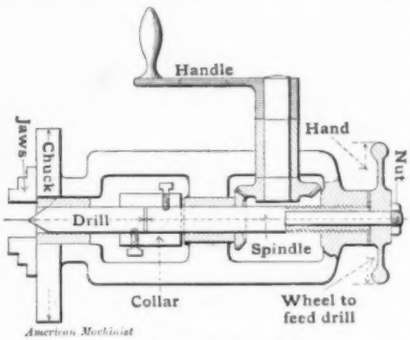
Editor American Machinist:

I have been reading your valuable paper for about four or five months. I find many things that are of interest to me, and perhaps this little machine may interest some.

I have been running a shafting lathe for several years, and find there is need of a machine for centering shafts quickly and accurately. A few weeks ago I made the machine of which I give sketch, and find it works well and quickly. It is a very simple machine, as you will see. I made it to use in the shop where I work (G. W. Wheland, Chattanooga, Tenn.).

I don't think there is one made like it. We have a machine for centering short shafts about 6 or 8 feet long, made differently and driven by a belt; but it is not convenient for centering shafts from 18 feet to 25 feet.

I use a universal chuck on the lower end, with three jaws to hold the end of the shaft. In the hole of the chuck I put a bush that has a hole through it that fits



SHAFT-CENTERING DEVICE.

the drill. I use a twist drill about $\frac{5}{8}$ inch, with a tip on the end of it, to drill and countersink all at once. The bush keeps the drill from running off to one side; so you can see, if the chuck catches the shaft true it is sure to center true.

It is much easier to handle this little machine and attach it to the end of long shafting than to handle the shafting, and the work is done well enough—better, in fact, than some shaft centering is done.

S. E. SHATTUCK.

St. Elmo, Tenn.

▲ ▲ ▲

Measuring Balls with the Micrometer.

Editor American Machinist:

Mr. Hugh Dolnar seems to want to acknowledge, without letting anyone know it, his little error of statement—or, rather, of deduction—about the results of micrometer measurements. On June 25th he told us about measuring the balls with the micrometer, and he said that "if sorted to the nearest $\frac{1}{4000}$ inch the diameter variation is, of course, less than $\frac{1}{8000}$ inch." This is, of course, incorrect, as the variation may be anything less than and right up to $\frac{1}{4000}$ inch. Now to make it appear all right, July 30th, Mr. Dolnar has been and got up a lot of boxes that did not appear at all in the original description, and from the use of the boxes, as he now tells it, the balls that measure to the nearest $\frac{1}{4000}$ inch are dropped into one certain box if the measurement comes on one side of the nearest $\frac{1}{4000}$ mark, and into another certain box if the measurement comes on the other side of the same nearest $\frac{1}{4000}$ mark, or, what is the same thing, those balls that measure to the nearest $\frac{1}{4000}$ inch are divided at the same measurement into two parts, and by reason of this subdivision may correctly be said to never vary more than $\frac{1}{8000}$ inch. I have no doubt the readers of the "American Machinist" will be satisfied with the explanation.

TECUMSEH SWIFT.

▲ ▲ ▲

Sizing Gear Blanks Without Figures—A Roller Ratchet—Piston Rod Fits.

Editor American Machinist:

Having received some valuable pointers from "American Machinist." I feel as if I might give some of the boys a hint on sizing gear blanks for their lathes, without figures. I will give the story as it happened.

Bill always wanted a chance, but could never get one (he hung around the street corners evenings), although he told the boss he knew just as much as the other fellows did.

Well, one day he got a job and had not a 90 gear which was necessary to cut some of the threads in connection with it. He reported to the boss, who happened to be busy just then, and his reply was: "Well, Bill, you want a chance; now take it. Turn up a blank the right size; you will find a casting in the shed about right." Bill then asked him: "What will be the diameter of it?" The boss replied: "Figure it out." Bill was in a hole

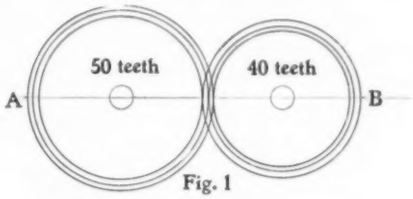


Fig. 1

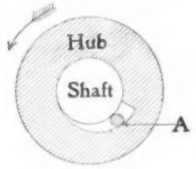


Fig. 2
American Machinist

SIZING GEARS WITHOUT FIGURES.

that he did not fit, or, in other words, he was stuck. He came to me and said: "Look here, North, the old man has got me this time; I want you to show me how to figure out the size of a gear blank for my lathe, to have 90 teeth." I then started to teach him how by diametrical pitch, as the gears for that lathe were 12 pitch, but he got so muddled that he was lost entirely. Well, as we could not spend the remainder of our lives on the problem, and Bill got to feeling so bad because he could not work it out, I did not know just what to do to help him, as he wanted to work it out himself. Then an idea came to me, which was as follows: Take two gears, one with 40 teeth the other with 50; lay them on the lathe-bed, just as they would run (Fig. 1); measure across from *A* to *B*, and you have the diameter of your blank for 90 teeth. Now, of course, the same idea applies if you use two or more gears, in fact any number of gears, so long as the total number of teeth is the required number; but they must be laid so that all the centers will be in a straight line.

In the "American Machinist" of June 4th J. P. Williams gives a sketch of a self-tightening pulley, which brought to mind a wheel I saw twenty years ago. It was fast to the shaft when running in the direction of the arrow, and loose when driven in the opposite direction. Fig. 2, *A*, is a small roller. The power was conveyed to the shaft from the pulley—not from the shaft to the pulley.

I rather like Mr. Halsey's idea of the straight fit of the piston rod in the crosshead. I have handled quite a number of them, and am able to say one thing in favor of the plan—that is, the convenience of drawing the piston when doing repairs. Just while the other fellow was looking for something to start the crosshead, a tap with a heavy hand-hammer did the business after the key was out.

NORTH.

Sherbrooke, Que.

▲ ▲ ▲

Revolution Mark in Milling.

Editor American Machinist:

With reference to George W. Marshall's article published in your columns of July 16th, on the mark left by milling cutters on work, would say that it is due to the grinding of the tool. Practically, a cutter cannot be ground true, for by the time you round to the forty-seventh tooth the emery wheel you are grinding with is smaller than when you started the first tooth, thus graduating the teeth of the tool till the last one is perhaps one or even two thicknesses of paper larger than the first. This graduation causes the tool to take a very strong grip, thus drawing it closer to the work, and then losing its hold and not cutting at all in the place where the tooth is small. It is just the same as a tool running from a small to a large cut; you are perhaps taking a $\frac{1}{16}$-inch cut, and running onto a $\frac{1}{4}$-inch cut, but on coming to the $\frac{1}{4}$-cut you will find you are taking perhaps a $\frac{1}{32}$ inch or a $\frac{1}{16}$ inch more than you expected to.

ERNEST MCGRATH.

Brooklyn, N. Y.

▲ ▲ ▲

It is reported that the Austrian War Department has adopted an improvement on the Mannlicher rifle, which brings the weight of that weapon down to 7 pounds 4 ounces, and makes it by far the lightest magazine gun in the world. The new gun will use the same ammunition as the older one, and the latter will not therefore be discarded at once, but will be gradually displaced as the production of the new gun armory enables it to take the place of the old one. This reduction of weight enables soldiers to carry more ammunition.

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Keeping Up with the Procession.

Progress is not all hurrah. There are always some who are being left behind, and the dropping by the way of the maimed and the halt causes sometimes a pang of regret. While we mourn the loss of those who drop by the way, we still largely measure our progress by them. It is the past always that must tell us how fast and how far we have gone. We cannot gage our speed by our rate of approach to any point ahead of us, for we can never see far enough in that direction. Even in looking backward it is necessary to still keep our vision advancing. Our point of comparison must be shifted ahead from time to time, or we can no longer make accurate and reliable observations. There are those who fail to do this and who keep their eyes still fixed on the far-away landmark, and when it grows dim and distant they whine and sob over the change in the landscape.

Such as these are in the machine shop as much as elsewhere. Where are the old-time machinists? they say. Where is the hand-tool latheman? Where is the old chipper and filer, or the manual skill of the old all-around man that flourished in every shop? Alas! they are gone forever. What of it? Who now wants them, or, indeed, could find a use for them? We not only do things in different ways and by different means, but we have also different things to do, and all the talk and all the thought of the shop is changed.

To remark with regret that things are not what they were is one way of recognizing, and perhaps of accepting, all this, but it is not the best way. The vision of the optimist is always more correct and more to be relied on than that of the pessimist. The change that progress brings is only to be regretted by those who are left behind.

The mechanical journal can least of all afford to dwell too long or too lovingly upon what has been. Its engrossing business is with what is and with what is immediately coming; and dealing with these it must, of course, change continually. The topics of a generation ago, and the new practices which could be urged with force and seriousness then, could not be so treated to-day without incurring the reproach of advancing senility. A half a generation ago the things that so largely occupy the thoughts and employ the hands of the mechanics of to-day had not come into prominence. Electricity, compressed air, the bicycle and the horseless carriage must be spoken of now, for they are the facts of the time. To say that we have changed and that we are not as we were in our infancy is only to say that we grow, and there is no higher praise for us. To continue always as we are and as we were is possible only for the dead.

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The Engineer as a Business Man.

One of the most sensible suggestions connected with technical education that that we have seen in years, is now being urged upon the authorities of the Stevens Institute by its graduates. The suggestion is for courses of lectures on such subjects as book-keeping, banking, investments, patent law, laws of contracts and specifications.

We gather our information from the annual address of the President of the Stevens Alumni Association, from which we take the following pertinent words: "It must be remembered that the financial side of engineering is always the most important, and that the sooner the young engineer recedes from the idea that, simply because he is a professional man, his position is paramount, the better it will be for him. He must always be subservient to those who represent the money invested in the enterprise."

The fact that mechanical engineering is primarily a matter of business, and not of scholarship, is ignored altogether too much in our engineering schools. The average fresh graduate looks upon the "mere business man" as of a distinctly lower order than himself, while the business college is considered as a subject for contempt. And yet, limited as is the instruction of the business colleges, we have no hesitation in saying that, to the graduate who has had no contact with business, a supplementary course in such a college would be of more value than any equal period of time in his technical course. Every man of intelligence should have a correct idea of modern methods of book-keeping and banking, while to the engineer a knowledge of patent law and practice, and of contracts and specifications, is, sooner or later, a necessity.

The ignorance of too many business managers of the technical side of their business is a subject of constant jeering by mechanical specialists; but the equal ignorance of business considerations on the part of technical men is equally and justly a subject for derision by the business man. This ignorance is, in fact, too often simply discreditable, and does more than any other one thing to limit the usefulness of engineers. Back of all this, a knowledge of both book-keeping and technology is involved in a subject of fundamental importance, cost-keeping, and the man who combines a knowledge of both subjects can be of the greatest value in this direction.

It was a knowledge of these facts which led Mr. Eckley B. Coxe to deliver his eulogy upon the business engineer, whom he characterized as of the highest order and the best-paid of his profession

The interest of technical school graduates in the progress of their "Alma Mater," is a most cheering sign, and it is but natural that such suggestions should come from them. Made up, as most of our engineering faculties are, of men of little or no business experience, they must depend largely upon their alumni for suggestions and assistance in these directions, and they can do no better than to follow them. When technical men become also business men, we may look for less friction between the two sides of every manufacturing business, and for a new and better order of things in our industrial enterprises.

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A New Arrangement.

In order to take care of an increasing advertising business, and at the same time make room for all the reading matter we desire to publish, additional pages have been put into the "American Machinist." In making this change we desired also to secure, if possible, better results from our half-tone engravings, and to shorten the time between going to press and the receipt of the paper by subscribers, which accounts for the change in arrangement, use of two kinds of paper and absence of colored cover. As to cover design, while there were many who liked the design we had on the cover, others did not like it. We have fixed it so that no one can criticise the design, because there is none.

This arrangement enables us to give a full table of contents in the most convenient place, and the mechanical production of the paper is simplified and facilitated.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(000) Q. E. D. asks: A mass W being moved over a plane surface, it is found that the resistance due to friction is equal to 10 per cent. of its weight. If it is desired to give the mass a certain acceleration, will the force required be just the same as though friction were eliminated and 10 per cent. added to the weight of the mass? A.—Let $W =$ the weight of the original mass, $p =$ the aceleration to be given to it, and $g =$ the acceleration due to gravity. In the first case, with friction included, the force exerted will be

$$F_1 = \frac{W p}{g} + \frac{W}{10}$$

In the second case, without friction, but with the percentage added to the weight, the force exerted will be

$$F_2 = \frac{W + \frac{W}{10}}{g} p$$

$$= \frac{W p}{g} + \frac{W p}{10 g}$$

It will be seen that F_1 and F_2 are not equal, except for the special case where $p = g$, for which case we should have

$$F_1 = F_2 = W + \frac{W}{10}$$

The reason for all this will be clear if we consider that in the first case the force required to overcome the friction is a constant quantity, without regard to what the acceleration may be; whereas in the second case the added mass must be accelerated with the original mass, and the force required to do this depends upon the acceleration given. F_1 and F_2 become the same when $p = g$, because the force required to produce the acceleration of gravity is the same as gravity; and hence, the force absorbed in accelerating $\frac{1}{10} W$ is $\frac{1}{10} W$, which is the same as amount absorbed in friction in the first case.

(000). "Pneuma," Rockford, Ill., writes: I wish to run an air motor a half-a-mile from a steam-driven air compressor, using the air at 60 pounds pressure and cutting off at the most economical point. I wish to know approximately the size air compressor needed and also the size of the air pipe. The available steam pressure is 85 pounds. A.—With air at 60 pounds at the motor we would cut off at one-third stroke. The mean effective pressure would then be 32 pounds and the terminal pressure about 1 pound. We first determine the size of the motor. The required foot-pounds per minute would be 33,000 $\times$ 20 = 660,000. Assuming the piston of the motor to travel 300 feet per minute, the total mean pressure on the piston should be 660,000 $\div$ 300 = 2,200 pounds, and as the mean effective pressure is 32 pounds, the piston area is 2,200 $\div$ 32 = 68.75 square inches. The diameter corresponding to this area would be about 9⅜ inches, so we adopt 10 inches for the diameter of the motor cylinder. The I. H. P. under the above conditions would then be $10^2 \times .7854 \times 32 \times 300 \div 33{,}000$ = 22.848, and deducting 10 per cent. for friction, the actual horse-power will be 22.848 — 2.285 = 20.563. The air consumption, cutting off at one-third stroke, would be $10^2 \times .7854 \times 100 \div 144 = 54.54$ cubic feet per minute, or, adding 25 per cent. to this for clearance and other losses, 54.54 + 13.64 = 68.18 cubic feet per minute = 68.18 $\div$ 60 = 1.136 cubic feet per second. We assume a 3-inch pipe for transmission in this case, and as the cubical capacity of 1 foot of 3-inch pipe is .049 foot, the velocity of flow would be 1.136 $\div$ .049 = 23.2 feet per second, which would not be excessive. The additional pressure or head required in this case to overcame friction would be about 7 pounds, so that we may assume that the air is compressed to 70 pounds, and upon this basis we may compute the capacity of the compressor required. The volume of air at 60 pounds being 68.18 cubic feet per minute, the volume of free air will be 68.18 $\times$ 5.08 = 346.4 cubic feet. Assuming the piston speed of the compressor to be 300 feet per minute, the capacity of the air cylinder should be 346.4 $\div$ 300 = 1.1546 cubic feet per foot of length. Then 1.1546 $\times$ 1,728 = 1,995 cubic inches, and 1,995 $\div$ 12 = 167 square inches, the required area of piston. This is a little less than the area of a 15-inch circle; but to have a sufficient margin to cover losses, it will be better to make the cylinder 16-inch diameter. The mean effective pressure, or resistance, in adiabatically compressing free air to 70 pounds gage pressure, is 33.73, and the power required for the compression will therefore be $16^2 \times .7854 \times 33.73 \times 300 \div 33{,}000 = 61.65$ horse-power. As this is the power required at the air-compressing cylinder, the I. H. P. of the steam cylinder should be, say, 10 per cent. higher than this. It is not necessary here to go into any computation as to the steam cylinder. The power at the steam cylinder being 61.65 + 10 per cent. = 67.82, the ratio realized at the motor will be 20 $\div$ 67.82 = .2948. By compound compression with thorough intercooling, by reheating the air at the motor, and by the careful elimination of all losses by leakage, clearance, etc., it is possible to at least double this ratio; but without any special precautions, the ratio realized will not be far from what we have computed it.

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Business Specials.

Transient Advertisements 40 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear wheels, gear cutting. Grant; see page 7.

Forming Lathes, Mer. Mach. Tool Co., Meriden, C.

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Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

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Engineering Trades in Great Britain.

Matheson & Grant, of London, in their "Engineering Trades' Report" dated July 20th, say:

"Mechanical engineers and machine tool makers are mostly busy, and there never was a time when more interesting problems presented themselves for development. There is no lull in the demand for mining machinery; a new era of locomotion is expected by many from the introduction of road engines, or auto-motors, but these anticipations are probably premature. The removal of the existing legislative restrictions to the use of engines on the highways will doubtless encourage and extend their use, but none of the machines yet available are satisfactory. Oil or gas engines seem to offer the most likely method, and the present opportunities and experience may tend to the removal of certain imperfections that still retard their progress. Mechanical haulage on tramways is receiving increased attention, now that corporations appear willing to expend public funds in providing facilities already available in other countries. The system of haulage by wire-rope cables seems hardly likely to be extended; the overhead electric trolley system is most in favor, but presents many drawbacks; while the alternative conduit electric system is not yet sufficiently perfected to justify its adoption. But whichever of these methods ultimately prevails, considerable expenditure on steel, iron and machinery must result, which will be beneficial to the engineering trades of the country. Those among the leading mechanical engineers who now undertake also electric installations, have been actively engaged and are likely to continue busy. It has become evident that such a combination is more effective than where electrical engineering is worked as an entirely separate business. Electric transmission of power, not only for long distances, but for local distribution in and about factories and mines, is being rapidly developed; such an application of power is in many cases successfully associated with electric lighting schemes, and various subsidiary trades are finding profit in the manufacture of plant and apparatus. Portable electric tools are also being introduced in the shipbuilding and other trades. The use of cycles in all countries which have good roads, has grown so rapidly as to have created a new industry. The demand has been so great, and the consequent prices so considerable, as to have induced large investments of capital, which will, by the extended competition, shortly cause a falling off of profits. The tube makers, however, who make these tubes by a special process, have benefited, and attempts to construct machines of aluminium will afford experience useful to engineers for other purposes.

"Locomotives and Rolling Stock.—The demand for locomotives has, during the last twelve months, been gradually overtaking what, for the last four years, has been a superabundant power of supply. All the works may be said to have orders in hand, which will occupy them for the next six months, so that, in regard to new business already in view and which can scarcely be postponed, manufacturers may look for more remunerative prices. This branch of trade is well defined, as the number of

makers and their capacity of output are known to all concerned. There has been no inducement to increase the number, for during recent years engines of the highest class, with every modern improvement, have been supplied on terms quite insufficient to induce the investment of further capital in this branch of trade. On the main lines of this country, the tendency is still towards heavier engines and higher pressure of steam."

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Death of John J. Hogan.

John J. Hogan, inventor of the Hogan boiler, died at his residence, Middletown, N. Y., on July 30th, of Bright's disease. Mr. Hogan was born in Ireland, receiving his education in Dublin and in Belgium. He was later apprenticed at the Reading Iron Works, near London, a fee of $1,500 being paid for his indentures. His residence in the United States had been principally in New York and St. Louis until the establishment of the boiler works at Middletown.

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In the last annual report of the North German Lloyd's, the directors, after referring to the contracts lately made with German firms, conclude with the hope that German builders will in the future be able to obtain their building material exclusively from home manufacturers. That the company's hopes in this direction will become a certainty is evidenced by the placing of the three additional ships in German yards for construction, and more especially if it is to be believed, as stated, that the company intends to place all future orders for ships with German shipbuilders who will guarantee the use of none but German material.

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The recent practice of providing for lubrication of drills by tubes to carry lubricant to the point of the drill, has been followed by the Newton Machine Tool Works, of Philadelphia, in the case of milling cutters. The arbor is drilled lengthwise, and at the point where the cutter is placed radial holes pass outward and through the cutter, the openings being between the teeth. The lubricant is forced through these channels and is said to give a very beneficial effect. On cast iron, air may be forced through.

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Bids were opened at the Japanese Legation in Washington a short time ago for two cruisers for the Japanese Navy. Bids had been asked from only two concerns; that is, the Cramps, of Philadelphia, and the Union Iron Works, of San Francisco. The bids were largely on the bidders' plans, and for vessels of about 5,000 tons displacement and a speed of 22½ knots. The result of the bidding has not been made public.

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A Sheffield manufacturer calls attention to the severe American competition in the English markets. He says: "My agent writes me that a large order, for which we quoted an outside discount, has gone to America at 67½ per cent. and 5 per cent., and this, with freight and charges, represents approximately 70 per cent. off Sheffield list, which will mean a heavy loss if supplied by Sheffield manufacturers."

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H. R. Lash, a representative of Selig, Sonnenthal & Co., London, engineers and tool builders, and representatives of several American tool manufacturers, is here, looking about.

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The famous Harland & Wolff shipbuilding establishment at Belfast was destroyed by fire on the 27th ult.

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Commercial Review.

NEW YORK, SATURDAY EVENING, AUGUST 1st.

Engines, Boilers and Pumps.

It is easy to prophesy the conditon of trade a long time ahead in these days, because there is little of what is technically termed "outlook." Since probably no one conversant with the situation expected anything approaching animation during July, we need hardly mention that nothing of that kind has occurred. But this must not be taken to imply that nobody is busy. In high-speed engines, at least, there is a fair amount of trade. One leading company reports such to be the case this month, as compared with their sales last month; yet in spite of this they do not consider the situation improved, just because of this want of outlook to which we have alluded.

High-speed engines for isolated incandescent lighting plants partake less of the "have-to-wait-until-after-election-to-see-any-business" character than do some classes of engines, for while a fair amount of large building is being done, they are a necessity. A local company tell us that they know of about six orders for high-speed engines which must be placed before a great while. Some of the most important contracts recently placed for plants for buildings in this city are as follows: Bank of Commerce building — engines, 400 horse-power, Ball & Wood; boilers, Babcock & Wilcox; dynamos, Siemens & Halske. Murray Hill Hotel, remodeling of plant — engines, 400 horse-power, Payne; boilers, already installed; dynamos, Walker. Windsor Hotel—engines, Watertown; boilers, Heine; dynamos, Walker.

It is an object with everyone in such times as the present to curtail expenses to sheer indispensables. It is for that reason that new enterprises remain so long on paper and that high-speed engines are easier to sell than the more pretentious Corliss type, of which a man thinks twice before investing. "It is not a question of prices; nobody wants any boilers," says a seller of the same. It is true that low prices will not create purchasers, but they are a matter of vast importance in securing the few purchasers who are in the market. Take, for instance, a contract which was recently snatched by an engine company comparatively little known from before the face of others of much greater prestige who were trying to obtain it. "They underbid us $1,000 on two small engines," says one of the latter. But, on the other hand, we have just heard of a similar contract which was not awarded to the lowest bidder, and perhaps the former case alluded to may be explained upon the ground that the successful bidders are striving for a better introduction into the market.

Here is a proposition to which some of the trade assent: that price cuts more of a figure with boilers than engines. In other words, that while buyers appreciate the fact that a good engine is more economical than a poor one, even if it costs a little more money, they prefer a cheap boiler, thinking, doubtless, that it will generate as much steam as a more expensive one, so long as it lasts, and if it doesn't last—they may not live to know the difference. Without vouching for the accuracy of this comparison, we submit it to our readers, thinking that it may accord with what has been noticed by some of them in respect to dull-time trade. The contrary would seem to be implied by the fact that at least one company which has earned a large reputation for its boilers is flourishing like a green bay tree, and the reason assigned therefor is, that only the strong concerns are able to buy at present, and that they want good boilers.

The trade in steam pumps partakes of the nature of that in other classes of machinery.

In addition to what has been learned this week, concerning the business situation in steam goods, from New York indications, we have communicated with a number of out-of-town companies, and print herewith terse opinions from all of them. As these were obtained without previous knowledge of the quality of their business, they should furnish a good criterion of the experience of manufacturers generally.

From the Valley Pump Co., Easthampton, Mass.: "Our business is exceedingly good for these times, as we are running complements of men sixty hours per week. We are increasing our line of both pumps and elevators."

From the Rice & Sargent Engine Company, Providence, R. I.: "We were fortunate enough to secure orders before the Chicago convention that keep us busy for several months yet. Just now there are few inquiries received; but we look forward to a good, profitable engine business in the near future, certainly by next spring."

From the Dickson Manufacturing Company, Scranton, Pa.: "As far as we are concerned, the present situation of stationary engines is unsatisfactory. The

prices are entirely too low for good engines. We are, however, getting our share of engines to build. There seem to be numerous inquiries, and we believe that if confidence were once re-established, the trade in engines would be very much better."

From the Hewes & Phillips Iron Works, Newark, N. J.: "We are quite busy in our several departments, on old orders, but regret to say that very few new orders are coming in, and that the outlook for business for the balance of the year is not at all encouraging. It is our hope and belief that a Republican triumph in November will again start the wheels of industry."

From the Keystone Engine & Machine Works, Philadelphia: "The condition of matters to which you refer is of such a character, that it seems to be a very difficult matter to explain intelligently, but, theoretically, we believe that the depression is caused by the unsettled condition of the money question. So far as we are concerned, business has been fair thus far this year. We do not feel as though we ought to complain, believing that others, perhaps in the same line of business, have suffered more seriously under certain circumstances. We are buying just enough to supply our immediate needs, and while we find collections exceedingly slow, we consider ourselves very fortunate in being able to pay promptly as we go along. There is at present some business in sight; competition is very strong, and were we able to obtain one-third of that which we have figured on, we should consider ourselves very fortunate. We are disposed to 'sail close to the wind' for a time, and ascertain, if possible, what the outcome of the present political agitation will be. We are not shrieking, and do not propose to howl until it is really necessary."

Exports of Machinery.

We called attention, last week, to the fact that the exports of machinery from the United States have during the past year assumed very gratifying proportions. Believing that the matter is of peculiar moment to manufacturers at the present time, we propose to compile and print weekly a summary of the outward manifests of machinery from the port of New York, which comprise a large portion of those of the entire country. The term "machinery" as used in this connection is not necessarily confined to machine tools, pure and simple.

For the week ending Saturday, July 25th, our computation of the machinery exports from New York to foreign American countries and islands is $38,211; to Europe, $61,762; to other countries, $21,769; total, $121,742. For the week ending August 1st, the exports from here to American countries were $26,506; to Europe, $87,514; to other countries, $10,652; total, $124,672.

The following information, brought to light by the correspondence of the "American Machinist" may be appropriate to give in this connection: The Davis & Egan Machine Tool Company, of Cincinnati, report having taken a larger export business last week than in any previous week of their experience. It included a $15,000 order from England, a considerable portion of which is for the equipment of the works of Humber & Co., of Coventry, Eng., recently burned; also orders from C. Shinz, of St. Petersburg, for seven machines, and from the Simplex Machine Co., bicycle manufacturers, of Amsterdam, for six machines. A representative of Armstrong Bros. Tool Co., of Chicago, dealers in machinists' supplies, etc., recently made a trip through Canada, with the result of increasing greatly their sales in that country. They had from the 1st to the 27th of July shipped there over 500 tools.

Iron and Other Metals.

The Steel Billet Manufacturers' Association met yesterday in New York. Although the meeting took place behind closed doors, it has been learned that the business was chiefly of a commonplace nature and that the prices asked hitherto were reaffirmed. Another market feature is, that the city of Brooklyn has awarded the anticipated contract for fifteen miles of riveted steel water pipe, about five feet in diameter.

In this section the other metals have passed a quiet week. The exports of copper have been about 2,205 tons, making about 10,715 for the month and 68,700 for the year to date, against 39,426 during the first seven months of 1895. The prices of copper have greatly declined since their gains, made some weeks since.

The arrivals of tin for the month have amounted to 1,825 tons, the consumption being estimated at 400 tons less.

Not a great deal of lead has been sold in this market during the week, the amount being estimated at 600 to 700 tons. But the quantity exported has been over 1,500 tons.

Pittsburg Report for July.

Trade conditions in the Pittsburg district have varied but little during the past month. For the last few months nothing of a startling nature has developed, and the prospects are for a continued absence of a heavy business until after the coming election. This is almost an assured fact. Many are making inquiries for material both heavy and light, but they do not want to place any orders until after November next. Money collections are still rather poor.

The amount of business now being done is limited to actual necessities, and no orders are being placed for a dollar's worth more than is required. In some of the leading lines of trade, production is being restricted, simply to keep stock from accumulating. It was expected by some that the depression would soon let up, and prices would advance, but within the past few weeks the conviction that nothing better need be expected seems to have strengthened, and prices, in the raw iron market especially, are again moving downward. No. 1 foundry iron is selling at $12 @ $12.25, and No. 2 at $11.50 @ $11.75. These irons are probably in a better condition than any other grade, but conditions are such that Southern mill product is adopted in preference to home product. The only things that have kept the iron market on its present basis are the stiff price for ore and the united action of the Bessemer steel manufacturers.

Foundries are not rushed with orders, but are kept running part time. Several new foundries are contemplated in this vicinity, also a large plant for the manufacture of high-grade machine tools. This plant will be erected by Lea & Carroll, of the Lewis Block, Pittsburg, who desire bids on the equipment of the plant.

The summer shut-down of nearly all the mills has boomed business in mill supplies, as nearly every concern needed some repairing. The Pittsburg Gage & Supply Company and Chas. Turner are well filled with orders calling for belting, hose, valves, gages, etc. Prices are fair for this line of goods and are being well maintained.

Between water-works systems and electric-light plants, engine and boiler people are kept busy bidding on the work. No less than a dozen plants are now under consideration within the city, notably those for the new Phipps building, Schoenberger Steel Company and others. The electric-light plant at New Wilmington, Pa., is to be enlarged and a new water-works system installed at Coraopolis, near this city. At a meeting of the Allegheny City council, a few days ago, the question of awarding a contract for boilers was reconsidered, and the award given the Erie City Iron Works, who were $1,000 cheaper

(Continued on page 38.)

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Help Wanted.

Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our subscription list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Position by a first-class power hammer forger. Box 243, AMERICAN MACHINIST.

Exp. mech'l engineer, speaking Spanish, wishes to change; best references. Box 250, AM. MACH.

Mech. dftsman, wishes a change; all-round man gen. and elec. machy.; 20 yrs.' exp. B. M., AM. MACH

Comp. draftsman, grad. wants pos.; exp. in design'g engs., boilers, gen. machy. E. P., AM. MACH.

Pattern maker and draftsman desires a change; can design either machinery or office furniture. Box 248, AMERICAN MACHINIST.

(Continued on page 38.)

(Continued from page 37.)

than the company which had previously been under contemplation.

The demand for lathes, planers, etc., does not amount to a great deal, and dealers are very much discouraged. Prices in this line are tending to weakness, although they seem to be as low as they possibly can go. Inquiries are numerous, but these are probably made for the purpose of feeling the market.

The probabilities are that things will run along in this manner until after the financial question is settled, whether it will be for gold or silver. When this is finally over, one may look for a decided improvement in all lines.

Quotations.

NEW YORK, Monday, August 3d.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00@$13 00
No. 2 foundry, Northern	11 75 @ 12 25
No. 2 plain, Northern	10 75 @ 11 00
Gray Forge	10 75 @ 11 00
No. 1 foundry, Southern	11 00 @ 11 50
No. 2 foundry, Southern	10 50 @ 10 75
No. 3 foundry, Southern	10 00@ 10 25
No. 1 soft, Southern	10 50 @ 11 00
No. 2 soft, Southern	10 25 @ 10 50
Foundry forge, Southern	10 00 @ 10 25

Bar Iron—Base, in Carloads—Mill price, on dock: common, 1.10 @ 1.20c.; refined, 1.20 @ 1.50c. Store prices: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.70c

Tool Steel—Ordinary sizes, standard quality, 5¾ @ 7c.; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—From store, about 1.75. Special brands upward.

Cold Rolled Steel Shafting—Base size in carloads, about 2½c.; 2¾c. for smaller quantities from store.

Copper—Carload lots, Lake Superior ingot, 10¾ @ 11¼c.; electrolytic, 10¾ @ 11c.; casting copper, 10¼ @ 10¾c.

Pig Tin—For 5 and 10-ton lots, 13.45 @ 13.55c. f. o. b.

Pig Lead—In carloads, 2.90c.

Spelter—In carload lots. New York delivery 3.90 @ 4.00c. for standard Western brands.

Antimony—Cookson's, 7.25c.; Hallett's, 6.45c.; Japanese, 6.45c.

Lard Oil—Prime city, 39 @ 40c.

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Manufactures.

The Brantford Electric Light Co. will install new machinery to cost $25,000.

A new machine works will be erected at Cumberland, Pa., by C. W. Taylor.

The Messrs. Allan Bros., of Grimsby, Ont., Canada, intend to build a planing mill.

The Phillips Gas Company, Butler, Pa., will erect a gas plant and place new machinery.

The Mecklenberg Iron works, of Charlotte, N. C., are about to place new machinery.

American Clay Mfg. Co., Pittsburgh, Pa., will erect a plant and install new machinery.

A forge shop, 80 x 350 feet, will be built by the Block & Pollock Iron Co., of Cincinnati, O.

Hamilton Bros., Latrobe, Pa., will erect a large glass factory and will install new machinery.

The Crawford Mfg. Co., Hagerstown, Md., will add additional machinery to their bicycle plant.

The Citizens Electric Co., of Athens, Mich., has been incorporated and will light that town by electricity.

The Reading Shale Brick Co., Reading, Pa., will build a large brick plant, and install new machinery.

The Delta Electric Power Co., Delta, Pa., will erect a plant and place a line of new and improved machinery.

W. F. H. Garber, New Bloomfield, Pa., will soon erect a paper mill and will place improved machinery in same.

The United Traction Co., Pittsburgh, Pa., will install boilers, engines, dynamos, belting, shafting, hangers, etc.

(Continued on page 39.)

Help Wanted.

(Continued from page 37.)

Wanted—By the Nellis Belt Fastener Co., 284 Pearl street, New York, hustling salesmen on their patent fastener and pulley covering.

Experienced designer of automatic and special machinery is open for engagement; highest references. Original, care AMERICAN MACHINIST.

Mech. draftsman and tool maker, Swede, tech. educated, wishes position; 10 years' office and shop experience. Box 247, AMERICAN MACHINIST.

Wanted—Position as iron molder, green or dry sand, light or heavy work; 25 years' experience both as foreman and workman. Box 249, AM. MACH.

Position wanted by prac. mach'st & tool maker, 12 years' exp. in handling men and making piece wrk. prices; vicinity Cincinnati. Box 241, AM. MACH.

Wanted—Experienced milling machine hand to take charge of a plain mill and three gear cutters in the West; permanent position to a reliable man. Box 246, AMERICAN MACHINIST.

Wanted—Position by practical foreman in manufacturing line; 6 years' experience in handling help on small and medium work; good references. Box 237, AMERICAN MACHINIST.

Wanted—To represent manufacturer in Central West, by experienced mechanical engineer of Pittsburgh, having good acquaintance with iron and steel works people. Address Box 245, AM. MACH.

Wanted—Position by a Stevens graduate; exp. in drafting; thoroughly exp. in indicator work and testing; position with consulting engineer preferred; best references. Box 230, AM. MACHINIST.

Practical machinist, good address, technical education, exper'ced in mech'l and civil engr'g work, desires pos. as trav. salesman with mfg. concern; has had some experience. Ad. Box 244, AM. MACH.

Wanted—Head draftsman, capable of acting as assistant superintendent; one familiar with Corliss engine and compressed air preferred; state present salary. S.C. H., 14 Lafayette Place, New York City.

Superintendent of large factory wishes to change; am in charge of 200 men; practical tool maker and draftsman; can invent and design special watch, clock and auto. machy.; prefer elect. mfg.; good ref.; correspondence solicited. Box 233, AM MACH.

Superintendent will soon be open for engagement and wishes to correspond with parties requiring the services of a man of thoroughly practical and executive ability; extensive experience in the manufacture of elect'cal apparatus, Box 229, AM. MACH.

A first-class mechanic holding a position as foreman, building high speed engines, long experience, a hustler, and up to times, would like to go on the road a month or two; object, health is poor and at the same time looking for a healthy location. Parties in need of a first-class man write me for particulars. Box 242, AMERICAN MACHINIST.

Mechanical engineer, graduate in civil engineering from a European college, wants situation where careful work is appreciated; experienced in transmission and heavy general machinery, turbines, power installations, hydraulic and modern structural work; a chance to secure the services of a man who, with thorough theoretical knowledge, combines 18 years' practical shop and office exp.; references as to ability. Box 236, AMER. MACH.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co.

For sale—Buckeye Eng., pract. new, 11x14, rating 70 to 90 H.P., $450.00. S. M. York, Cleveland, O.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co. Middletown, Ohio.

Cheap for quick sale.—1 Wheeler Planer 42 x 42, very heavy, first-class condition; cost $1,900, will sell for $650. Butterworth & Lowe, Grand Rapids, Mich.

We offer an exceedingly fine lot of first-class second-hand machinery, lathes, planers, shapers, drills, millers, screw machines, etc. Call or get list 17 B. The Garvin Mach. Co., 440 Canal st., N. Y.

A VALUABLE BOOK

NEARLY READY.

Gas, Gasoline and Oil Engines

By GARDINER D. HISCOX, M. E.

400 Pages. 200 Illustrations. Price, $2.50.

This book treats comprehensively, and almost entirely of American makes of Gas, Gasoline and Oil Engines, with instructions for the care and management of the same.

The author has probably had more experience with the manufacture, care and management of Engines of the above type than any other man connected with the subject.

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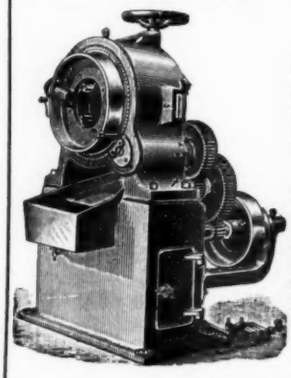

CURTIS & CURTIS,
66 GARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting and Threading Machinery,
FOR HAND OR POWER,
RATCHET DRILLS, RATCHET DIE STOCKS AND
MALLEABLE IRON PIPE VISES.

DYER & DRISCOLL,
PATENT SOLICITORS, 36 WALL ST., N. Y.

have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.

Thomas A. Edison

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

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WM. B. FRANKLIN, Vice-President.
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J. B. PIERCE, Secretary and Treasurer.

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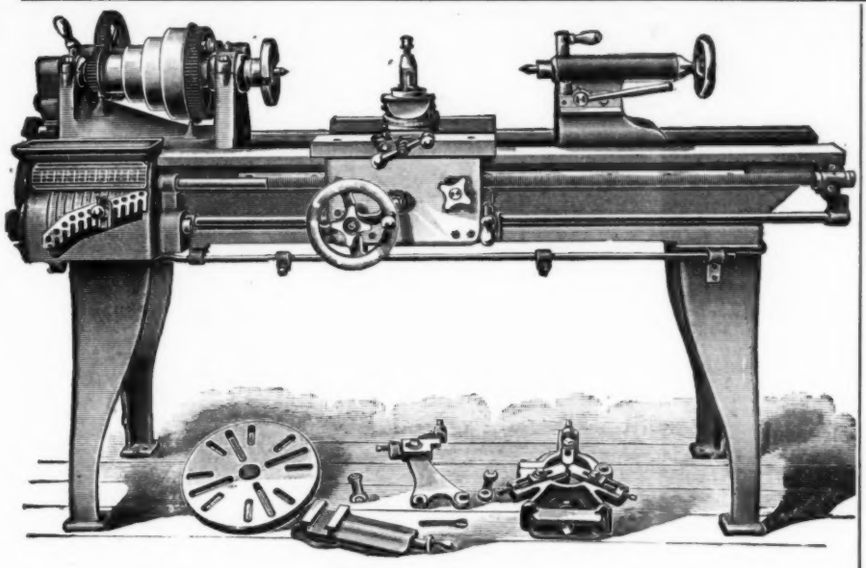
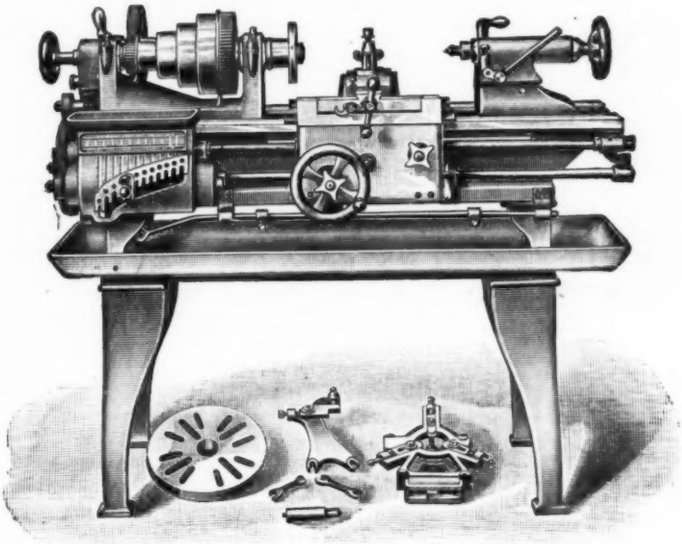


14-in. x 6 ft. Hendey-Norton Lathe, and 12-in. x 4 ft. Hendey-Norton Lathe. These are modern, high-grade, practical tools, and are specially adapted for tool-room work. They have the Norton Attachment for screw cutting, giving 36 different threads and 36 different feeds with only two changes of gear, and movement of lever in gear box from one notch to the other. Note the automatic stop under apron. It will automatically stop carriage at any desired point in either direction. Invaluable for internal or duplicate work.



The 12-in. Lathe is fitted with drawing-in sleeve and American Watch Tool Co.'s Standard Chuck, used in making small taps, reamers, etc. Work finished first and cut from bar afterward. No centering required. See carriage reverse lever by right-hand side of apron; no reaching for countershaft shipper required.

SEND FOR CATALOGUE.

The Hendey Machine Co.,
TORRINGTON, CONN.

European Agents:

CHAS. CHURCHILL & CO., London, Eng.
SCHUCHARDT & SCHUTTE, Berlin, Germany.
EUGEN SOLLER, Basel, Switzerland.

(Continued from page 38.)

The Acme Brick Co., Philadelphia, Pa., will at once erect a large plant and install new machinery of the latest type.

Chas. Churchill & Co., of London, have moved their establishment to 9-15 Leonard street, Finsbury, London, E. C.

W. H. Darlington, New Bloomfield, Pa., will erect a braiding works, etc., and will install a boiler, engine, etc.

The report published last week to the effect that the Carnegie Steel Co. would engage in bicycle manufacture is incorrect.

The Lancaster Peerless Emery Wheel Co., Lancaster, Pa., are increasing their works and will place a lot of new machinery.

The New Cumberland Novelty Co., New Cumberland, Pa., will erect a plant in the near future, and will install new machinery.

The Champion Blower Co., Lancaster, Pa., are building a new plant to manufacture blowers, etc., and will install new machinery.

The factory of the Mossberg Mfg. Co., Attleboro, Mass., will be closed for the usual annual vacation from August 6th to 16th, inclusive.

Mackay & Quest, Renfrew, Ont., Canada, intend erecting an isolated water power plant and another machine for their electric light system.

The Savage Arms Co. may move their works from Utica, N. Y., to a more favorable location, in which case they will put up larger shops.

The Welliver Manufacturing Co., Phillipsburg, Pa., will erect a plant to manufacture bicycles and install a line of new and improved machinery.

The ratepayers of Amherst, N. S., Canada, have decided to expend $8,000 in schools, $10,000 for waterworks and $2,000 in fire protection improvements.

Two by-laws will be submitted to the ratepayers of Deseronto, Ont., Canada, on August 7th; $35,000 for a waterworks system and $3,000 for fire station and appliances.

The Hutztown Foundry and Machine Co., Hutztown, Pa., will erect a plant to manufacture a general line of machinery work, and will install all new and improved machinery.

The Fairbanks Wood Rim Co. has been organized at Bradford, Pa., for the manufacture of wood rims for bicycles. They will build a plant immediately, and install new machinery.

A stock company has been organized at Battle Creek, Mich., to manufacture a voting machine patented by Mr. R. A. Hart, who is to be general manager. The capital stock is $500,000.

Louis Humphreys, of Chicago, Ill., and Samuel Foster, of Pittsburgh, Pa., are the heads of a new corporation to be formed in Tiffin, O., for the manufacture of farm implements. Capital $1,000,000.

The Mossberg Mfg. Co., Attleboro, Mass., has been reorganized as the Mossberg & Granville Mfg. Co. As soon as a suitable plant can be constructed it is expected that about 500 men will be employed.

W. H. McEvoy, of Amherstburg, Ont., with some Toronto capitalists, under the name of the Amherstburg Electric Light, Heat and Power Co., and a capital stock of $20,000, are seeking incorporation.

Jackson, Mich., is soon to have another wheel company to be called the Jackson Wheel Co., with a capital stock of $30,000. R. H. Emerson, Sidney S. Heywood and Melville W. Thompson are the principals.

The Hawley Down Draft Furnace Co. will establish a branch factory at Detroit, Mich., with a capital stock of $100,000. Several Detroit people will be interested in the new concern. A site is yet to be selected.

The Niagara Cycle Fitting Co., of Buffalo, N. Y., manufacturers of bicycle parts, have leased the building on Niagara street, formerly occupied by Sweet's Baby Carriage Co., and will install new machinery to enable them to keep up with their orders.

(Continued on page 40.)

(Continued from page 39.)

The Hamilton Cycle Co., of Hamilton, O., will, on August 10th, remove their factory to Grand Rapids, Mich., where the company will be known under the name of the Hamilton-Kenwood Cycle Co., and will continue the production of the "Hamilton," "Kenwood," "Wellington" and "Sligh" bicycles.

The N. Y., P. N. & O. R. R. will remove their large car and repair shops from Salamanca to Falconer Junction, 1½ miles east of Jamestown, N. Y. Larger shops will be built, also new machinery of the latest design will be installed in every department, especially for locomotive building for their own use.

The Barnes Cycle Co., of Syracuse, N. Y., will soon begin the erection of a five-story brick addition to their present shop, making it when completed 284 feet long. They will put in a new engine of 120 horse-power, together with other new and up-to-date machinery for the production of high-grade wheels.

The McAnulty Mill Co., of Manheim, Pa., offer to locate at Fort William, Ont., a flour mill machinery manufactory employing 150 hands, and a roller flour mill, 1,000 barrels capacity, at a total outlay of $300,000, for a free site, exemption from taxes for ten years, and $30,000 cash bonus. The council intend doing all they can to secure the industry.

A new company, known as Thayer & Co., has been incorporated in New York City, with Winthrop Thayer, Boston, W. C. Turner, Philadelphia, Frank A. Thayer and Rodney Thayer, New York, as principals, to engage in the manufacture and sale of the Babcock & Wilcox horizontal water tube boilers, also the Cahall vertical boilers. The office of the new concern is 39 Cortlandt street, New York.

The machine department of the Springfield Foundry Company, of Springfield, Mass., and the Valley Pump Co., of Easthampton, Mass., have consolidated, forming a new corporation, to be known as the Springfield Elevator and Pump Company, and will manufacture hydraulic, electric and power elevators, and the full line of steam and power pumping machinery formerly built by the Valley Pump Company, at Easthampton, Mass.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

Boston Gear Works, Boston, Mass., have issued a new catalog of gears of all kinds, transmission chains, etc., containing full tables of dimensions, prices, etc. It is 5 x 8 inches.

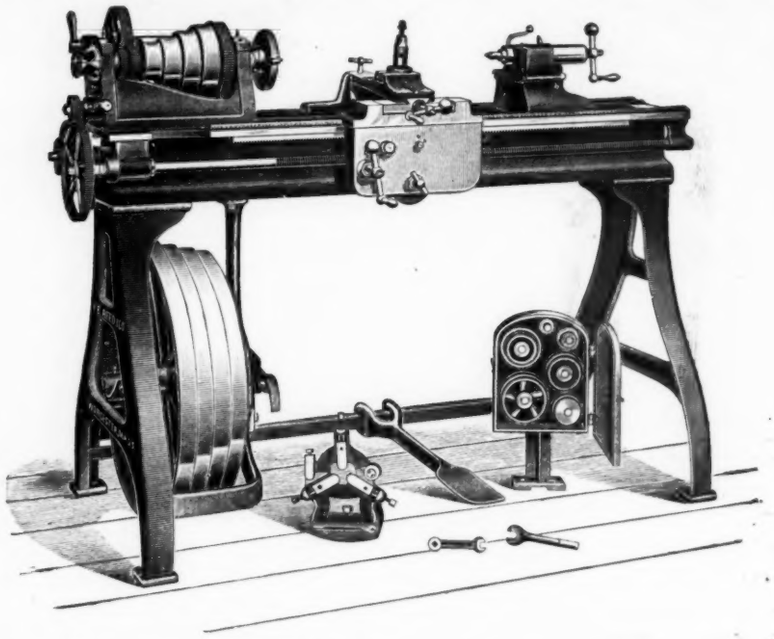
Thos. Kane & Co., Chicago, Ill., send us a pamphlet describing the "Victor" vapor engine, which is based on the invention of Mr. E. J. Pennington. It is standard size, 6 x 9 inches.

The Rollins Engine Co., Nashua, N. H., send us a pamphlet illustrating and describing the "Rollins" automatic engine, which, in general appearance, resembles the "Brown" engine. It is 8⅜ x 6½ inches.

F. E. Reed & Co., Worcester, Mass., have issued a new catalog illustrating and describing their very complete line of lathes and attachments, and accessories for the same. It is standard size, 6 x 9 inches.

Whitcomb Mfg. Co., Worcester, Mass., send us an illustrated catalog of planers of various sizes, also planer chucks, index-centers, hand shears and punches, and power punching and shearing machinery. It is standard size, 6 x 9 inches.

The Hilles & Jones Co., Wilmington, Del., have issued catalog "M," in which are illustrated a number of heavy punching and shearing machines of various types and for a variety of purpose The catalog is large standard size, 9 x 12 inches.



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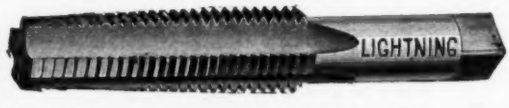

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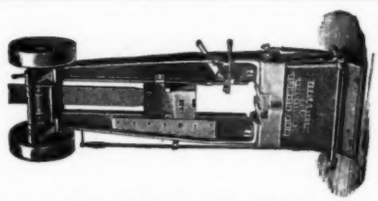

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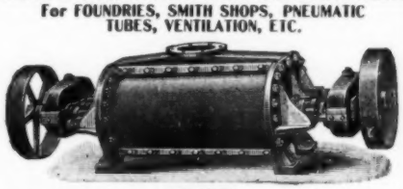

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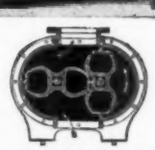

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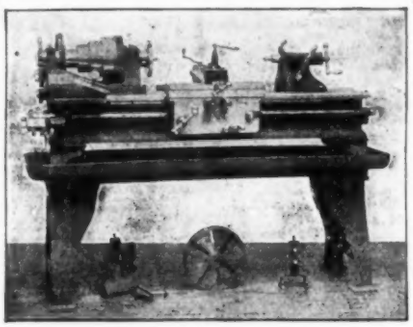

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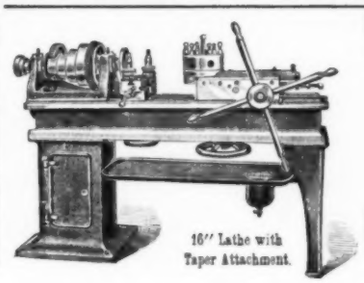

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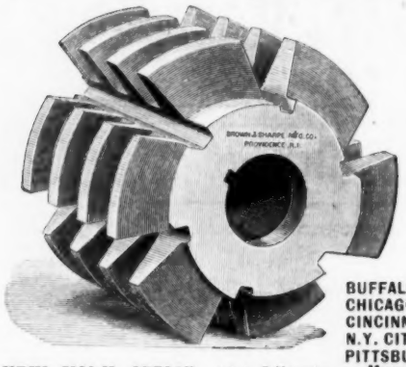

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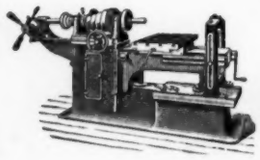

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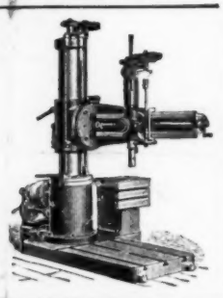

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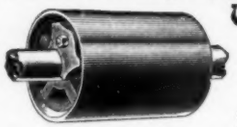

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